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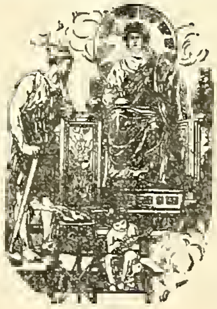

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THE

WATCHMAKER, JEWELLER,

AND

SILVERSMITH.

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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No. 74.—VOL. VII.] JULY 5, 1881. [Subscription, 5s. per Annum. Post Free.

Machine Work *versus* Hand Work.

A REPLY TO MR. JAMES U. POOLE.

Continued from page 157.

No. VII.

ON page 41, October number of this Journal, Mr. Poole writes:—"Let us now suppose the young beginner commencing his first task, which, in my experience, was to whet up a graver—a task, simple as it seems, requiring much skill." In connection with the whole of this course of instruction, which has reference to the lever escapement, I shall take into consideration the statement made by Mr. Poole, page 72 in the January (1881) number of this Journal:—"It affords me pleasure to say here that I have recently inspected the models of the various forms of the lever escapement constructed by Mr Curzon, the teacher of escapement-making at the Horological Institute, and consider them admirably adapted for the purpose intended, *and that the course of instruction is peculiarly suited to the wants of young men who have imperfectly learned their business.*" The subject I propose to examine in this paper is the making and sharpening of cutters, and there are few things in which the machine tool has of late years played a more conspicuous part than in the matter before us: not only has the graver come within its grasp to receive benefit, but every conceivable form of cutter is now made by machinery. The smallest as well as the largest drill receives a more perfect cutting edge, and the point is thereby made exactly central. The saw and milling tool of many shapes give testimony to its advantage. The milling machine, which, for uniform work, has superseded the file, may be said to be unknown in English watchmaking. The wheel-cutter, with any desired curve or angle for cutting train or scape wheels, is now made by machinery with that degree of smoothness and sharpness, that when the wheel comes from the engine the teeth are almost polished. Every description of slide-rest cutter for swift or smooth cutting is now sharpened in a machine, giving the desired rake to half a degree. The tap, the reamer, the drift, the press tool, are all witnesses of its advantages, and yet are all unknown in English watchmaking.

In any good engineering shop in this country, in which due regard is paid to economy of production, no workman leaves his lathe or machine to make cutters, but asks a porter to bring from the store what he requires. If he is making a wheel, he has only to mention the number of teeth and the diameter of the pitch line, and the desired cutter is forthcoming.

In order to show the disadvantages under which we labour in respect of making and sharpening cutters, which Mr. Poole has truly said is "a task requiring much skill," I have recently had a wheel-cutter made in Prescot, which is a fair specimen of a cutter having the freedoms or slopes made by hand, which I have sent to the office of this Journal, together with a machined cutter made on the Continent, and the sketch of an American one (I regret I cannot obtain an American wheel cutter just at this moment), and I ask an impartial judge, Is it possible for us to compete with men who use such tools?

Any workman who will note the time occupied in sharpening his tools, will see how large a proportion of the cost of production lies in this operation; and if substantial advantages are offered to us by machinery, we cannot afford to neglect them. Unfortunately, our workmen are taught by those who have made themselves leaders in the trade to regard the machine tool as a fearful foe, whereas it is a faithful friend, a powerful ally. We have yet to learn the difference between slave driving and engine driving, and enquire how much truth there is in the verdict of those who deride this matter as the "cuckoo cry of machinery, and the war cry of machinery—as a *mere puff as applied to best watches*." Such statements are too ludicrous to demand serious reply. Can best work be made with inferior cutters? Nobody can deny there has been, and that there is, puffing about machinery; in like manner the coin of the realm and the Koh-i-noor have been counterfeited; but we do not reject them on that account.

I naturally recoil from speaking against a public institution; but willingness to show deference can be no plea for neglect of duty. With this motive, in the interests of English watchmaking, especially the younger members of trade, I will unflinchingly lay before you what I have seen at Mr. Curzon's class at the Horological Institute, confining my remarks in this paper to cutter-making, and dealing with other matters in due course.

Nothing whatever in this department is taught save the primitive process of sharpening upon the ordinary oilstone. I asked the teacher to show me his improved process of cutter-making; and he replied, "We have none." I examined a *single tooth* cutter in the wheel-cutting engine, that it would be difficult to conceive of anything more crude. I have known the teacher of this class for more than twenty years, and for at least ten years he has been one of the most indefatigable makers of machine tools for escapement making in this country. When I visit his workshop at Tottenham, he shows me machine tools made upon the same basis as those used in the small arm factory at Enfield, by which every kind of cutter can be quickly made to the greatest degree of perfection that is necessary for the best escapements that are made. Now, if the teacher of this class finds so much advantage in machinery in his workshop at Tottenham, why is the use of machine tools withheld from the young men who are under his care at the Horological Institute? And how much truth is there in the statements made by Mr. D. Glasgow, in his letter to the *Times* newspaper, April 16th, when he says, "English horologists are most anxious to give every attention to anything that will contribute to either their mechanical or commercial success," and that the representatives of the trade are, "with the assistance of the City and Guilds of London Institute, doing all in their power to educate a body of men that will maintain the prestige of English horology."

In passing from this most important subject—the making and sharpening of cutters, to which I may not have an opportunity of referring again—I cannot do better than commend Mr. Poole to the exceeding pity of those American watchmakers, of whom I have not yet heard him speak, save in terms of reproach.

I am not a little refreshed by the manly statement of my opponent in last month's issue—"That, with a sincere desire of enlightenment, I have inspected the chronograph spring." Of course, Mr. Poole is not writing with the slightest expectation of altering my opinion. The bare assertion, "a detent cannot be made by machinery," in the face of evidence to the contrary, is not calculated to alter well-established views of a question. I write with a very different object, for I feel quite sure that I can alter his views on this point. I have never questioned Mr. Poole's right to enjoy his opinion, and when he urges this claim, he evades the point at issue.

Mr. Poole says:—"The spring in question is used for one purpose only, viz., for steadying the wheel which carries the chronograph hand by means of a slight downward pressure, and is too thin to *polish* or manipulate in any way after being left by the machine."

Thomas Earnshaw, a good authority, says:—"The dettant-spring is to fall into the teeth of the scape wheel, to stop it at every tooth; it should be no stronger than just necessary to do so."

I submit the resemblance is very close. Now, if Mr. Poole will take the spring in question to Mr. Curzon's workshop at Tottenham, who has kindly consented to place it in a surface grinding machine, and by means of a fine diamond powder-lap will reduce it to half its present substance, and make it any desired shape; and when Mr. Poole has fully grasped the nature of this machine-tool operation, I shall be glad to hear from him again.

Mr. Poole is beginning to talk about "achieving a victory over Mr. Whittaker, and fairly turning his flank." I protest against this summing up of the case. I have a thousand witnesses to examine yet. Suppose a plaintiff whose case had been patiently heard was to rush in front of the judge, while the witnesses for the defendant were being examined, and, with a flourish of trumpets, to make such an announcement in his own favour; would not this be wanting in respect for the judicial bench? and by making such premature suggestions, I think Mr. Poole is scarcely "content to be judged by the numerous readers of this Journal."

RICHARD WHITTAKER.

P.S.—The paragraph in small type in my paper for June has been misplaced. It should have appeared after the word "stile," at the end of the first sentence in the next paragraph.

To be continued.

A Japanese Bronze Worker.

The most skilful living bronze worker in Japan, and one of the most skilful of workers in metal that Japan has ever possessed, is said by the *Japan Mail* to be a Kujoto artisan, named Zoroku. His specialty is inlaying with silver and gold, an art which he carries to such perfection that his pieces are scarcely distinguishable from the *chef-d'œuvres* of the Miu period. What one sees on going into his *atelier* is a very old man—about sixty-five or seventy—peering through a pair of huge horn spectacles at a tiny incense-burner, or still tinier flower vase, from whose frets and diapers he is paring away, with marvellous patience an almost imperceptible roughness or excresence. Beside him, winter and summer alike, stands a brazier with a slow charcoal fire, over which an iron netting supports one or two bronze vessels similar to that he holds in his hand. Plainly, these bronzes are being subjected to a slow process of baking, and if you watch for a moment, marvelling at the purpose of a proceeding which seems only calculated to mar the fair surface of the metal, you shall presently see the old man dip a feather into a vessel filled with greenish liquor, and touch the heated bronze here and there with the most delicate and dexterous care. This liquid is acetate of copper, and this patient process, which you see repeated perhaps twenty or thirty times during a visit of twice as many minutes, will be continued in the same untiring fashion for half-a-year to come: after which a month's rubbing and polishing will turn out a bronze, rich in green and russet tints, that might, and, indeed, must, you would fancy, have been produced by centuries of slowly-toiling time.

The Application of Hand Work.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—A quotation from the able and instructive paper of Mr. Whittaker's in your last issue will very suitably introduce the topic I am about to handle, viz., that a chronometer escapement (and work of similar character) cannot be made by machinery. He says:—"The machine tool succeeds only in cheapening the production of *large quantities* of duplicated work that are uniform in size and style. Machine tools offer no advantage in making very small quantities of work."

It is the many variations in style which form the chief feature in the best English watch trade, for, by the custom of the trade, every watch is supposed to be the actual make of the person whose name it bears, and, in many instances, a special style is retained in order to preserve the identity of the establishment from which the sale is effected.

Even in the marine trade there are many slight variations in the callipers of the movements, which would involve continual alterations in any tool which might be employed to rough the detents out, while, for pocket chronometers, the frames vary so, that I question if more than half a dozen of one size and style are made by any maker in the course of a year.

I will now refer to Mr. Whittaker's instructions for making a detent by the aid of a machine tool. After describing the methods of shaping it out, he says:—"Then harden and temper. Finally fix it in the grinding machine, and polish every part of it, leaving the reducing of the spring for the last operation."

Now, I maintain that the secret of the construction of a detent lies in the proper carrying out of the above directions, and the various processes described can only be done by hand. To commence: It is known by every practical man that a detent can rarely be hardened without acquiring a slight twist or warp, which has to be set off to the best advantage during the process of polishing. Mr. Whittaker makes no reference to the fixing in of the locking pallett, or making the discharging spring and screw. These operations require very great delicacy. The pallett is only half round, and has to be fixed in by means of a brass plug, which fills up the remainder of the hole. When this is adjusted to the proper angle, it is shellacked in, and the detent is then planted on the frame. At first sight it would appear that the gold spring might fitly be stamped out by a machine, but it has to be so nicely adjusted to the dimensions of the detent, which may alter in course of completion, that nothing would be gained by the attempt, and it would have to be weakened and polished the same as if it had been made by the old process. The final polishing of the detent is now proceeded with, only bear in mind that the pallett is in, and it would be exceedingly dangerous and inconvenient to fix it in a "grinding tool," according to instructions given; besides which, I apprehend that such a tool would only polish up to a sharp edge, whereas the beauty of finished steel-work consists in every edge and corner being nicely taken off. It may be said that I am harping on trifles; but I would reply, as a celebrated sculptor is reported to have done, viz., that trifles constitute perfection, and that perfection is no trifle. The detent being weakened according to the judgment of the operator, and the gold spring screwed on, is now ready for final adjustment, and this leads up to the topic of the general examination of the escapement, which has remained so long in abeyance.

It is first desirable to ascertain that the escape-wheel teeth are perfectly free of the escape cock, and especially that the part which is turned out for the cogs is not only free of them, but also of the inside of the rim of the wheel, this last being a very insidious fault. Then see that the pallet in the large roller is safely free of each tooth, both top and bottom, and also that the roller itself is quite free of the horse-shoe banking. Take out the escape-wheel and balance, and put the detent in by itself, in order to ascertain that the gold spring is safely free of the banking screw, as many failures arise from this cause. Put the balance in, with only the small roller on, and see if the pallet is safely free of the end of the horn, and then replace the large roller to make sure that it is free of the top side of the gold spring.

The end of the horn is supposed to point exactly to the jewel-hole; if it does not, it must be bent. After the detent is weakened, it is "set on," in order to give it a spring towards the wheel, to make its return action safe; when the banking is off, the pallet should just rest against the rim of the wheel.

The action of the pallet in the small roller on the end of the discharging-spring is termed "the lift;" it should just move it sufficiently to allow the escape-tooth to pass the pallett in the detent, and no more; if there is too much lift, another tooth would come on before the detent had returned to its proper position.

It is most important that a chronometer should be perfectly in beat, otherwise it is certain to stop; the pallet in the small roller should just rest against the side of the gold spring which is farthest from the wheel when the balance is at rest. On being gently moved to the left, so as to pass the gold spring, and released, the tooth of the escape-wheel should immediately fall on the impulse pallet in the large roller, and the balance is moved round to the right, "lifting" the detent, and allowing the escape-tooth to pass on. Immediately the next tooth falls on the locking-pallet, the balance should be stopped, and if the beat is correct, it will go on again on being released.

The chronometer escapement is peculiar in requiring no oil, except, of course, to the pivots; and owing to the various parts being moveable, it is capable of very delicate adjustment. In the olden time, the springer and the escapement maker were one and the same person, but this necessarily limited production, and division of labour brought some workmen into the field, who really understood no more about the principles of an escapement than machines; and the failure of many chronometers to give satisfaction has been a principal cause of their being regarded with apprehension by retailers.

So long, however, as marine chronometers are used at sea, the pocket chronometer will retain its position in the estimation of the wealthy public; and it behoves all well-wishers of the art and science of horology not to degrade it by lowering the standard of excellence of workmanship, which has hitherto been one of its leading characteristics.

I am, yours, &c.,

33, Spencer Street,
Clerkenwell, E.C.

JAMES U. POOLE.

◆

Transparent Blue Enamel.—Five parts crystal glass; 1 part cobalt oxide; 1 part borax. First melt the glass, add the borax, and then, while well stirring, the oxide. Provide a good cover to keep out ashes, else the mass assumes a dead appearance. It is often sufficient to melt the mixture only once, at other times twice or thrice. Do not cast the enamel until satisfied that all parts are melted and thoroughly incorporated.

Intermediate Green Enamel.—Six parts crystal glass; 1 part potash; 1 part red lead; 4 parts verdigris; 4 parts borax; 1 part salt. Melted twice, because difficult to intermingle. A froth will arise to the surface, which must be removed. Have the casting surface well cleaned from all dust. A bluish green is obtained by the addition of a little cobalt oxide, and mercury dissolved in chromic acid, which is melted, purified in water, and added to the mixture.

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette* (*Saxony*).

(*Continued from page* 159).

108. The advantage claimed for setting jewels in this way, is a greater facility of replacing a broken or damaged jewel without re-gilding the plate or cock. This, however, does not weigh very heavy, because, if a good stock of jewel-holes is within convenient reach, it will be easy to find one fitting into the old setting; and even if this should not be the case, the purpose can be attained by setting the new jewel in a piece of brass wire of suitable thickness. This wire, after being turned exactly concentric to the hole, and of a slight taper, is adjusted into the hole in the plate, previously turned out, and then it is cut off at a length a little in excess of what it is required to be. This setting now must be gently driven into the hole in the plate till the proper end-shake is attained. The plate, or cock, is then cemented to a flat chuck, and well centred to the hole in the jewel, after which the slope is turned. If the brass setting has been turned to a proportionate size, it will be easily attainable that the slope extends a little beyond it into the plate; and in a plain-jewelled watch, if well done, the replacing of a jewel, in the way just described, can hardly be detected.

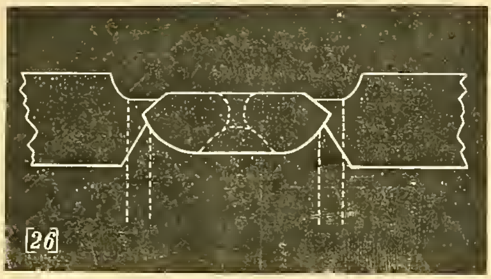

Fig. 29.

109. A movement with plain-set jewels is in no way inferior to one with screwed jewels, even, as has been explained, in the very exceptional case of the replacement of a jewel-hole. The movement with screwed jewels has a more elegant appearance, but it implies, if not done with the greatest care and discernment, a vast deal of trouble in the manufacturing, and still more so in the repairing. Not only must all the screws and jewels be taken out for thoroughly cleaning a watch, and put in again, but the very little thickness in which the screws have to take their hold, is a great source of annoyance to the repairer, especially in the English watches, with their thin upper plates of brass, rendered quite soft by gilding, and with screws of rather coarse threads (22). Any screw failing in its hold has to be replaced by one of the next number of thread, having, by its greater thickness, still less chance of a sound hold, and very often it is necessary to make other holes at fresh places. If, now, the screwed jewel presents the advantage of easy replacement of a broken jewel without leaving any lasting mark of the operation, this small advantage may be considered to be neutralized by the above-mentioned drawbacks.

110. However, the screwed jewelling may be improved in such a way as to make it much less liable to failure. There is not the slightest necessity for counter-sinking the screws in the upper plate; they might, without the least detriment to their functions, have flat heads, rounded at the top, which merely serve to hold the jewel down in its place, thereby reserving the whole thickness of the plate for the hold of the screws. The jewel-setting might be dotted as usual, for always having it in the same place in its sink, which is not without importance; and if it should be thought necessary to insure this position of the jewel, even against careless repairers, who might not pay any attention to the dotting, this might easily be attained by drilling a very small hole in the bottom of the countersink, into which a pin might be driven, and for the reception of which the jewel-setting ought to have a small groove.

CHAPTER X.

THE FUSEE.

111. In the period of the recoil escapement, the invention of the fusee was undoubtedly one of the most important steps towards perfection in time-keeping by portable instruments. The old vertical watch is to such a high degree under the influence of the variations in the intensity of the moving power, that it hardly deserves the name of a timekeeper, if not provided with a mechanism for equalizing these irregularities. The vertical escapement was superseded by the dead beat escapements, especially the cylinder escapement. One of the principal features of this latter is, that the locking and lifting take place at equal distances from the centre of the balance. The friction on the locking, therefore, is considerable, and acts during the greater part of the vibration. These circumstances have the effect that, with any increase of the impulse power, there is a corresponding increase of friction at the locking. This friction, it will be obvious, acts in a corrective way, and if the proportions of the escapement are well chosen, it is in a surprisingly small degree influenced in its time-keeping by any irregularity of the moving power. The duplex escapement works under similar circumstances, while the detached escapements, which have no correctional friction, may enjoy the independence of their time-keeping only by a judicious arrangement of the pendulum spring.

112. To begin from the time of the clear establishment of these facts, a rather different course was taken by the leading horologists in the different centres of horological manufacturing. The French and Swiss, with their practical endowment, immediately took advantage of this changed situation, and simplified the movement by dispensing with the fusee and its appendices. This step, together with some other circumstances, was the base on which the Swiss manufacture largely developed itself; because by these means they were able to produce a cheap watch of convenient and even delicate dimensions, and still satisfying the common demands of life.

113. The English, on the contrary, kept to the traditional fusee movement, even under so vastly changed conditions, and even now, notwithstanding a number of advocates of the going-barrel have sprung up amongst them in the latest period, the majority still adhere to the belief that the fusee is an indispensable characteristic of a truly English watch. The consequence of this conservative inclination is a well-maintained superiority of time-keeping in their better class of watches, but a gradual decrease of demand for the inferior qualities, and which, in fact, have ceased by degrees to be a marketable article.

(*To be continued.*)

◆

Opaque Blue Enamel.—Five parts pulverized crystal glass; 1 part calcined sheeps' bones; 1¼ parts calcined borax; 1 part cobalt oxide; ¼ part tin oxide. Pulverize all components. First put in the glass, then the borax; when melted, add tin oxide, then bones, lastly cobalt oxide. Melt it three times, and give it a strong heat. Never pour in water: it loses its opacity.

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Repairing Swiss Watches.

By Hy. Ganney.

(*Continued from page* 145.)

No. VIII.

ANOTHER centre made of brass is called the rounding up centre, and used for making pivots right lengths and rounding and burnishing them. It is simply a number of holes round a brass centre, which has been filed sufficiently thin to allow the finest and shortest pivots to protrude: the holes must be various degrees of fineness, and no more pivot allowed through than necessary, as the file or burnisher will break them off. Usually the pinions to common Swiss works are very soft: this, though greatly facilitating the turning when the work is large, becomes a troublesome quality as it gets fine: and it may be asserted that a fine pivot cannot be made from soft steel, as it will not stand the necessary pressure to turn or polish it to any great degree of fineness, and no amount of finish can be displayed on soft steel as it will not polish to advantage. In putting a new third pinion it is necessary to undercut the shoulder and leave a hollow in the pinion, or the oil may work into the leaves of the pinion and centre wheel teeth: before the wheel is rivetted to the pinion the balance should be put in to see if it is free, as in some callipers the circle intersects. The undercutting of the fourth pinion at the bottom pivot is also necessary to keep the oil in the sink, and the pinion left no higher than the third wheel requires, or it may foul the balance or banking pin; in polishing the seconds the best pivoters usually polish it like any other arbor, but if nervous or heavy handed, a special brass centre with half of its diameter filed away and a convenient slit for the pivot to rest nearly all its length in may be used, but I do not recommend it, as a careless slip will destroy the pivot, which otherwise in the turns would have a certain amount of elasticity. The resting of the little finger on a convenient part of the turns and letting it move with the polisher, is an item in polishing pivots, the finger being used to regulate the pressure of the arm and hand: the most troublesome pinion to pivot is the Geneva scape pinion, owing to its having no arbor. If a very thin and small brass ferrule is used, well chamfered to allow all parts of the pinion at its shortest to be turned, it may be opened to fit the pinion tightly, and the pinion driven in it will hold sufficiently to pivot; or it may be fitted loosely and shellac used to secure it in the ferrule. The value of good pointed centres will be proved in pivoting this pinion, as it cannot possibly be done without them. The rivet should be well undercut, and fitted to the wheel, or the riveting will raise a burr in the pinion where it acts in the fourth wheel; a few light blows must complete the riveting.

Good bows being necessary complements to good turns, the watch repairer cannot dispense with less than four, varying in lengths from 12 to 24 inches, and in strength from that sufficient only to make a balance pivot, with horse or human hair, without slipping on the ferule, when turning with a fine pointed graver; and the others increasing in strength to what is required in turning barrel arbors, stoppings, and the larger drilling operations in watch work; for the ordinary every-day watch pivots and shoulders are sufficiently well finished with a cutting burnisher, one side of which is rubbed on a board or strip of lead charged with emery, or a few rubs on the small stone used by shoemakers to whet their knives for leather cutting is a handy substitute, and gives the requisite cutting power; and then a few rubs with a burnisher, polished on a well-used burnishing board on which smooth emery has been distributed, will give a perfectly smooth and black pivot. The best Clerkenwell pivoters finish their pivots with the smooth burnisher in this way to harden them, though they have been previously highly polished with a soft steel polisher, which leaves the shoulder perfectly square and highly polished. Using bell-metal polishers to finish, though putting on a higher gloss, destroy the squareness of the shoulder: the shoulders are protected from injury whilst burnishing the pivot by a small tissue paper collet on the pivot, or by polishing the edge of the burnisher with a bell-metal polisher, and burnishing the pivot by moving the burnisher down (not up) the pivot as it revolves. Arbors are burnished in the same way, left from the steel polisher, and not too fine red stuff, in preference to more highly polishing bell-metal, as a square shoulder on the arbor is a *sine qua non* in good pivoting, and a too highly polished arbor will not burnish, but rubs brown or foxey under the burnisher; facing and rivet tools are simply pieces of iron wire, a tin tack, or an old nail with a hole in it, in which the arbor fits loosely, and these being filed and charged with polishing crocus, the pinion is revolved against them with a very weak bow, until the requisite finish is attained; the finest finish on faces is got from a tool made from a horseshoe nail, the iron being a particular Swedish quality, and the hammering it receives in wear imparting qualities that cause the pivoter who finds one to prize it like a diamond; otherwise, a bell-metal tool to finish the face is necessary, but only to give a few finishing rubs, as it soon loses the flatness imparted by the file, and makes the face or rivet rounding; a very careful stroke of the bow is necessary, as only a back centre is used, and the tool itself held in the hand forming the other centre for the pinion to revolve in. The pressure of the hand is carefully regulated to ensure a light and equal pressure; the progress of the face may be known by the noise the pinion makes; as it works the polishing stuff dry it begins to sing or squeak, and this is the signal for ceasing operations. If all parts of the face are well polished and the extreme edges as bright as the rest, it will do; if not, the tool must be refiled and fresh stuff applied, and the operation patiently repeated. More patience in this job is required than any other in watch work, and though apparently most simple, and, we may add, the most unnecessary in watch work, there are few who excel at it. The polishing of a square shoulder and pivot being a work of celerity, firmness, and skill, those who do the one often fail at the other, as shown by escapement makers, who make good pivots and bad faces to their one pinion, whilst the finisher as often as not produces better faces than pivots to his pinions. The repairer may emulate either or neither, but he ought to endeavour to replace old pieces with new equally good, or consign the job to those who can. In large towns he will not gain or lose much honour either way, his business being to get a satisfactory performance from the watch as a whole; but in putting in pieces to jobs there are certain little numberless details that give success in action, and only the one who is responsible for the performance of the watch seems able to appreciate or develop them. This is why cheap subdivided watch work is a failure, by reason of the numberless things which everyone is supposed to attend to, and for which no one is paid, or feel it their duty, or even have the ability to attend to; it is not so much their own work as the way in which that work acts with that which precedes and follows it, that makes such a demand for the examiner's and repairer's skill, which at its best can only act on finished work in a makeshift manner.

(*To be continued.*)

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The Silver Duty.

TO THE EDITOR OF "THE WATCHMAKER, JEWELLER, AND SILVERSMITH."

MR. EDITOR,—That the silver duty was at length fairly started in the Parliamentary Budget train, with fair expectation that it would speedily be brought to a terminus, and that it has since been detached and shunted for this session at least, are matters now sufficiently notorious to all concerned. That a Chancellor of the Exchequer who had to set all his wits to work in order to make the two ends of his financial arrangements meet and tie, should have felt somewhat staggered at the prospect of having to pay so much in order to achieve so little, cannot reasonably be wondered at: but the expedient he hit upon for the solution of the difficulty, could only have come from one who had not the needed leisure for thinking over the too certain results that would have followed on the adoption of his proposed action. But the plan met with universal condemnation from all parties interested, and has accordingly been withdrawn.

Mr. Gladstone, in answer to a question in the House a few weeks ago, said, "It is proposed to deal with it in a future session, *if at all*, in some manner different from that he lately detailed." That it must be dealt with as speedily and thoroughly as possible is now more than ever a matter of paramount necessity for those whose prosperity is bound up in that of the trade in sterling silver plate. Shopkeepers whose sales are contracted and slow, manufacturers whose capital makes them no return, and workmen whose daily bread comes to them cut in thinner shives because of the little demand for their productions, have all of them the keenest and most urgent interest in the speedy and final solution of this long debated question.

The public having, far more than ever before, had their attention drawn to it, are now aware of the nature of the silver duty, and without, as a rule, giving up much time to theorising on the matter, have got to know that it is in a very shaky condition and may be abolished any day: therefore they feel a well-grounded confidence in being able to supply their wants at a cheaper rate in a by no means remote future: it is not like food or clothing, and can stand over for a time, so they do not purchase, and the necessary consequence follows in the dwindled demand.

The great stumbling-block with any future finance minister, as it has been with Mr. Gladstone, will be the question of the drawback. That minister gave expression to a fear that he would be subjected to fraudulent claims, besides those which may be looked upon as legitimate. As he did not specify the grounds for this apprehension, we can only guess at them; but an examination of the evidence taken by the Parliamentary Committee will show that the claims proposed to be put forward by tradesmen of known respectability, are sufficiently formidable to make a finance minister pause and ponder in these days of restricted general trade, and consequent financial difficulty.

Mr. Attenborough, who appeared before the Committee as the accredited representative of 600 of the chief pawnbrokers in London, said, that while the silversmiths would require £120,000 as drawback on duty-paid stocks in hand, the pawnbrokers would claim £20,000 on like grounds. Taking it into account that the stocks held throughout the country may be roughly estimated at about the same in amount as those in London, it follows that the claims of the pawnbrokers alone would nearly swallow up the whole of one year's revenue from the duty which Mr. Gladstone estimated as being now only £48,000.

In the interest of the trade as well as of the public, the whole question of the drawback must be fully discussed and amicably settled if the drag is to be removed from the wheels by which the silver trade is carried forward. Whether it be right to expect drawback on articles which may have been bought and sold many times, which may fairly be considered as liable to all the accidents of the market, and which may to-morrow be enhanced in value by some sudden freak of fashion, is purely a question that few out of the narrow confines of a particular branch of the trade would answer in the affirmative.

During the excitement caused by the proposed change in the law, several incidents happened which showed that the whole question had entered upon a new phase, and that it had become evident, even to the most take-it-easy sections of the trade, that the duty and hall-marking agitation had at length entered into the region of practical politics.

Given but an earnest and indefatigable assailant, let his efforts lead up to a thorough investigation by a most competent Parliamentary Committee, and that again to a report strongly condemnatory of the law enquired into, and it needs no great gift of prophecy to foretell that a change is pending so soon as circumstances will permit. All these conditions have been fully borne out by the agitation on the silver duty, and the end is not far off.

One workman, at their trade meeting, took occasion to remark that they had been too backward from taking an active part in the agitation. They will be unwise if they do not let their voices be heard more earnestly in the question at issue. Let them remember Mr. Gladstone's words spoken in a parenthesis—"*if at all*"—which may be interpreted as meaning, that if those who have a direct pocket interest in the matter do not bestir themselves to urge on a repeal, how can they expect a finance minister to trouble himself about an affair that is so insignificant from a national point of view? The instinct of self-preservation should impel the men to meet, to discuss, and finally to act in concert for the attainment of an object which even the most resolute defender of things as they have been must see cannot longer subsist.

One other incident of the agitation is most noteworthy: the meeting of the trade at Goldsmiths' Hall. Apart from the immediate interest of the proceedings, it must occur to all that this looks like the beginning of a return to the practice of those days when not only members of the Courts and Livery, but also of the Commonalty, had a living interest in what was done there. Time and reason are in many ways working together for the revival of institutions which had been more or less turned away from their original purposes. It is in the power of the Goldsmiths' Company to be of incalculable service to the trades over which they have jurisdiction, and we may fairly indulge in the hope that, along with the power, there is now steadily growing an earnest desire to benefit a much depressed and disheartened branch of industry.

With a fellow-feeling for those who are even less fortunate than we are here, because they depend entirely on the demand for duty-paid silver, and a hope that even yet I may see the trade prosperous and flourishing after it has surmounted all its troubles, I once more subscribe myself as

AN OLD HAND.

Sheffield, *June 30th*, 1881.

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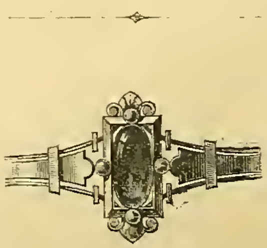

Practical Instructions to Jewellers, Silversmiths, and Electroplaters.

By A. Roseleur.

(Specially Translated and Revised for this Journal.)

Continued from page 161.

No. XXVI.

THE object previously well cleaned is scratch-brushed in every direction, and the brush must be frequently dipped into the mercurial solution to facilitate the regular and even spreading of the amalgam. This operation requires great care to obtain a uniform coat upon the hollow and raised parts. When the back part of a piece does not require gilding, the flat outline and the back edge should be gilt, so that the naked copper shall cause no injury in the subsequent operations. The article, when uniformly coloured with the amalgam, is heated upon a charcoal fire, without draught, which rests upon a cast-iron plate. It is advisable to employ a gilding forge, which allows the workman to watch the operation from behind a glass frame, which protects him from the mercurial vapours. The entire attention is now required for watching the process: with the left hand covered with a thick glove of buckskin, turn the piece in every direction upon the fire, and as the mercury disappears, with the right hand strike the article in every direction with a brush, the handle and the bristles of which must be long to equalize the gilding, and to push the remaining amalgam upon those parts which appear less charged with it. When all the mercury has volatilized, the gilding has a dull greenish-yellow colour, resembling that of boxwood: examine whether the coat of gold is continuous. Should a few empty places appear, add more amalgam, and heat the whole again.

The next operation is scratch-brushing, which furnishes a pale green colour, and requires another heating for arriving at the desired shade. The re-heating should expel any remaining mercury, and produce a fine orange-yellow colour. In case a bright lustre is required, submit the object, with the aid of heat, to the ormolu process already described. To obtain a dead lustre, the object is firmly fixed to an iron rod, by wire of the same metal, and smeared with a hot paste for dead-gilding, composed of saltpetre, common salt, and the double sulphate of alumina and potash. The whole is heated upon a brisk charcoal fire, without draught, and mixed about until the mixture dries and begins to fuse, when the article is immediately placed in a barrel half filled with water. The covering of salts dissolves, and the dead lustre appears; this operation requires a certain amount of practice. The gilding must be strong to stand the dead lustre process, especially when the first trial is not successful. The red lines left by the iron wire disappear by plunging the object into a not too diluted solution of nitric acid, or pure hydrochloric acid. Mercury gilders do not employ pure gold; what they use is previously alloyed with a certain portion of copper or silver. With the latter metal the gilding is green. Red gilding is either obtained with a dark ormolu, or with the green for red already mentioned.

Gilding with a partly Dead, partly Bright Lustre.—For nearly thirty years a combination of the wet process and fire gilding on the same object has been used for securing effects of colour: the wet gilding provides the bright lustre and the fire gilding the dead. To obtain these results, proceed as follows:—First gild those parts with the amalgam which are intended for a dead lustre, and heat, scratch-brush, and re-heat to the orange-yellow colour; then with the battery, give a sufficiently strong gold deposit to the whole, without regard to the parts already mercury-gilt; scratch-brush all the surfaces carefully, and smear the electro-gilt portions first with a thin mixture of water, glue, and Spanish white, and afterwards with a thick paste of yellow clay. After drying, cover the mercury-gilt portions with the paste for dead gilding, and proceed as already described. The Spanish white, &c., are dissolved in a dilute solution of hydrochloric acid. The glued paste is to preserve the electro-gilt portions from the heat. These are again wire-brushed with all the care necessary for not scratching the dead lustre; brushing to finish. This method will sometimes produce red spots on those places which have been heated too much, or where the coat of gold was not thick enough. Another method is: Gild with the amalgam, and bring up the dead lustre upon those portions which are to receive it, and preserve them entirely with the resist-varnish. After thorough drying, cleanse the object by dipping it into acids in the usual manner, and gild in the electro-bath. The resist-varnish stands all these acids and solutions. When the desired shade is obtained, dissolve the varnish with gasoline or benzine, which, unless there has been friction applied, does not injure either the shade or the velvety appearance of the dead lustre. Wash in a hot solution of cyanide of potassium, then in boiling water, and allow to dry naturally. The resist-varnish may also be removed by allowing the object to remain for a time in concentrated sulphuric acid at 66° Baumé, which has no action whatever upon the gilding. In this case, washing with cyanide is unnecessary, pure water is sufficient. Gilding with a dead lustre, whatever process is employed, only suits those objects which will never be subjected to friction: even the contact of the fingers injures it. A new freshness is imparted to old dead gildings by a washing in caustic lye, and then a dilute solution of nitric or sulphuric acid. This process removes dirt, grease, dust, and smoke, but will not remedy scratches. In the latter case, the objects must be scratch-brushed, and then heated with the composition for a dead lustre.

Gilding with a Dead Lustre.—There is now-a-days no artistic bronze, whatever the richness, elegance, and delicacy of its forms may be, that cannot be reproduced in zinc (called composition-bronze), with a perfection which often defies the most practised eye. The shops are now full of clocks, candelabra, vases, and other decorative objects, manufactured of zinc, and many of these articles have a simple coating of brass, bronzed afterwards to imitate similar objects of real copper, brass, or bronze; but others are gilt by mercury, either with a dead lustre, scratch-brushed, or burnished. With tin solder fill all the holes, and the smallest defects which may exist in the zinc object, and, at the same time, remove all seams, burrs, and rough spots. Afterwards, scour the piece by passing it, for a few seconds only, through a boiling solution of 100 parts of water, and 5 or 6 parts of caustic soda; if left too long in this caustic lye, it will spoil the polish of the zinc, which dissolves. After this scouring the object is rinsed in fresh water; it is then steeped for half a minute in a pickle composed of 1 part of sulphuric acid and 10 parts of water, and lastly rinsed in boiling water. Then place the object in a cold or warm electro-bath of copper or brass, for a few minutes, until it is covered with a thin metallic coating, which is deposited very uniformly if the object has in it no tin solder, and is perfectly cleansed: the deposit is black and dull on those parts which have been soldered, or imperfectly cleansed. In this case, thoroughly scratch-brush the article, and dip again into the electro-bath until the deposit is sufficiently thick. Most gilders use a warm bath for the first coating, scratch-brush, and complete the deposit in a cold bath. If a bright gilding only is required, the article may be rinsed in fresh water, and then dipped into an electro-gilding bath; but if, on the contrary, a dead gilding is wanted, rivalling in appearance the best mercury gilding, proceed by either of the following two methods:—

(*To be continued.*)

Specific Gravity

Of the Principal Substances Employed in the Manufacture of Watches and Jewellery.

By H. Bush, Hull.

SPECIFIC GRAVITY denotes the comparative weights of equal bulks of various substances. It has been found as most convenient and reliable to compare the specific gravities of all solids and liquids with that of water, which is taken as a standard, and reckoned as 1·000 or 1000. Distilled water of a temperature at 60° Fahrenheit is best adapted for the purpose.

The calculation of the specific gravity is principally effected by means of the hydrostatic balance in the following manner:

When the substance is solid and insoluble in water, it is tied to a horsehair and suspended to a hook on the bottom of the short hung scale, and weighed in the air. This actual weight of the article is noted down; it is then, thus suspended, immersed into the tumbler, which is three-fourths filled with distilled water. Care should be taken that it is covered on all sides by at least half an inch of water. Small air-bubbles frequently adhere to the surface, and these must be brushed off with a feather or camel-hair pencil, or else the specific gravity would appear too low. It will then be found that the substance is weighing less in water than in air, and this loss, or difference of weight, is the weight of an equal bulk of water as the article of which the specific gravity is to be found; and in order to find the specific gravity, the difference between the two weighings is divided into the weight in the air or the actual weight, the result being the specific gravity weight of the substance, or denoting how much it is heavier than its equal bulk of water, which will be found fully explained in the following example:

Weight of the substance in air	92·71	91·71
,, ,, in water	60·64	
Loss or difference on weighings	12·7	12·7
Specific gravity required - -	7·3	7·3

12·7 : 92·71 = 7·3

or 7·3 times the weight of the same bulk of water; the fractions are specified by decimals.

In order to ascertain the specific gravity of precious stones, the gem must be perfectly clean, and free from dust, grease, or any adherent substance, and before being weighed in water it must be rubbed in it to remove the adherent air, and if the stone be of a porous description it must be allowed to absorb as much as it is capable of before being weighed. The ascertainment of the specific gravity of gems is of great importance, as it affords a test of the greatest value, without any risk of injuring the gem. The stone is first weighed in the ordinary manner in the scales, and having noted the exact weight, a small piece of wax is pressed on to it, and a piece of wax of the same weight is placed in the opposite scale; the end of the hair attached to the short hung scale is fastened to the wax on the stone, which is immersed into the tumbler of water, and small weights placed into the scale above to effect an equilibrium, and the calculation effected as above.

In order to ascertain the specific gravity of solids *lighter* than water, a slight modification of the process is necessary. The substance is first weighed in air; then select a piece of lead of sufficient size to sink the light body in water, when attached to it, and weigh it (the lead) in water, suspending it by means of a hair loop, as before mentioned. If now the light substance be enclosed in the same loop with the lead and immersed in water, it will be found that it will together weigh less than the lead did alone, owing to the buoyancy of the lighter body; and this difference, when added to the weight of the body in air, is equal to the weight of a corresponding bulk of water.

The results may be recorded in the following manner:

Weight of body in air (cork) - -	—	1·44
,, lead alone in water -	8·5	—
,, lead with body attached in water - - -	7·9	—
Difference of weights - - . .	—	0·6
Specific gravity of cork - - -	—	0·24

The specific gravity of liquids is ascertained by means of gravity bottles, made to contain nearly 1000 grains of distilled water. One of these bottles is filled with water and carefully dried from water on the outside, and placed in one of the scales of the balance; another bottle of the same kind is filled with the liquid of which the specific gravity is required, and placed in the other scale; the difference of weight denotes the specific gravity, viz.:

Weight of bottle full of water: 1,000 of liquid: Spec. Gravity:

The specific gravity of liquids may also be determined by another process, which will be found useful when specific gravity bottles are not at hand. Take a piece of solid glass rod, with one end drawn out and turned in the blowpipe flame. Weigh it first in air and then in water, suspending it with a hair loop. Then, having wiped it dry, it is weighed in the liquid of which the specific gravity is required. The difference between the weight of the glass in air and in the liquid, representing in each case the weight of a volume of the liquid equal to that of the glass; and knowing the weight of a similar volume of water, the specific gravity may be known by the following simple calculations:—

Weight of glass in air
,, ,, in liquid

Loss of weight, which is the weight of an equal volume of the liquid, then noting down the weight of glass in water and the difference of weighings between water and liquid is the specific gravity of the liquid.

The following table gives the Specific Gravity of the principal substances employed in Jewellery and Watchmaking:

METALS, &c.

Aluminium, Plate	2·67
,, Cast	2·56
,, Bronze ..	7·74
Antimony	6·72
Bismuth	9·82
Brass	8·68
Cobalt	7·81
Copper	8·87
German Silver	8·67
Gold, hammered	19·53
,, cast	19·25
Iridium	22·41
Iron, wrought	7·78
,, cast	7·20
Lead	11·35
Mercury	14·39
Nickel, cast	8·28
,, hammered	8·67
Palladium	11·05
Platinum, hammered ..	22·00
,, welded	21·25
,, cast	21·50
Silver	10·47
Steel	7·81
Stereo-Metal	8·45
Tin	7·29
Zinc	6·86
Boxwood	1·33
Deal	0·55
Lime	0·44
Oak	1·17
Alum	1·90
Borax	1·72
Saltpetre	1·94
Salt	2·26
Chalk	2·72
Plaster	2·33
Alabaster	2·29
Marble	2·70

METALS, &c., *Continued.*

Slate	2·77
Alcohal	0·79
Benzine	0·85
Ether	0·73
Naphtha	0·97
Muriatic Acid	1·21
Nitric ,, ...	1·45
Sulphuric ,, ...	1·87

MINERALS AND PRECIOUS STONES.

Agate	2·57
Amber	1·09
Amethyst	4·00
Aquamarine	2·69
Coral	3·17
Cornelian	2·59
Diamond	3·52
Emerald	2·72
Garnet, Syrian	4·20
,, Bohemian	3·81
Jade	3·32
Jasper	2·64
Jet	1·30
Lapis-Lazuli	2·77
Malachite	3·96
Moonstone	2·58
Onyx	2·50
Opal	2·08
Pearl	2·75
Peridot	3·38
Quartz	2·65
Ruby, Brazil	3·52
,, Oriental	4·00
,, Siberian	3·05
,, Silesian	2·65
Sapphire	4·00
Topaz	3·50—4·00
Turqouise	2.70
Zircon	4·60

Soft Pinions, &c.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—I quite agree with Mr. J. D. Fisher, in your last, that the centre bottom and fusee top pivots are often seriously worn after going three or four years, and I would also add the seconds pivot to that list, and believe he will agree with me in doing so. But why are those parts in particular so given to wear? The other pivots in the watch are generally right. Are there not other causes besides softness of the steel employed that produces this effect? I would answer yes: in fact, I would say the softness of the steel has very little, indeed, to do with the wear. In a soft pinion and pivot, where should we look for the first sign of wear? Not in the pivot (which has been kept oiled), but in the pinion, due to the friction, of the wheel teeth on it. I have often seen those same pivots cut almost to an extent as to render new parts necessary, yet the faces of the pinion leaves have been as perfect as ever. Doubtless, Mr. Fisher has noticed that in many cheap foreign watches, with pivots quite soft, there has been but very slight signs of wear, although subject to very many years' going: while the pinion leaves are often cut to a very considerable extent. In American clocks, too, that have only iron pivots, they go for a great number of years without wearing to any considerable extent. The real cause, in my opinion, is the absence of oil from those parts: in fact, in really good English levers, that are sold at from £4 to £6 and upwards, every facility is often offered for the escape of oil from the parts above-mentioned, being drawn away by capillary attraction. In great wheel-holes, the bush is often conical and run up sharp, and close to the pivot, oil is drawn away by the key in winding and by the dust cup. Bottom centre-wheel holes of the same form, and the cannon pinion coming down close over it, the oil is drawn away to between the minute-wheel and plate. Dust falling through the seconds-hand hole in the dial settles around the seconds-pivot and dries the oil there. In foreign watches generally, the same facilities are not offered, and the oil is retained at the pivots. As soon as the oil is gone and the trifling quantity left dried up, rust and oxidation sets in, and the part is cut away very fast indeed. In old English watches, those bushes do not exist, at least, not in the same form: the parts are better adapted for retaining the oil, consequently they are not found to wear in this way.

By inserting the above in your next issue, you will oblige,

Yours sincerely,

Fore Street, Liskeard, WM. H. HUDDY.
June 13th, 1881.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—In your Journal for this month, I notice an article on "Soft Pinions," contributed by Mr. J. D. Fisher, attributing the quick wear of the bottom centre pivot and top fusee pivot to the softness of the steel. This, to a certain extent, is correct: but there are other causes, of equal importance, requiring the attention of all engaged in the manufacture of watches. As a rule, the watch finisher does not think it worth the trouble of making a proper shoulder to the centre arbor for the cannon pinion to rest against; it is let on, and left just free of the back of the plate, it then goes through the examiner's hands, who sees that it is free, and it is passed as correct. The watch next finds its way into the wearer's pocket, and by the time the hands have been set a few times (wearers are not always gentle over their watches), in consequence of the canon pinion having no proper shoulder to work against, it naturally works a shade lower than it was originally left by the finisher, touches the back plate, and in a very short time absorbs the whole of the oil intended for the back centre pivot. The watch continues to go in a sort of a way, and herein lies the secret of the cutting of the pivot. In oiling, I would strongly recommend the examiner or jobber always to oil his back centre pivot before putting the watch together, as in so doing it has a tendency to confine the oil more specially to its own hole than in the ordinary way of oiling after the watch is put together. As to the wearing of the top fusee pivot, it is caused by an improper guard being used, thereby allowing dust to be conveyed by the key whilst winding. Put on an improved guard, and the top fusee pivot will not wear as quick as it does.

I am, Sir, yours faithfully,

THOMAS ARMSTRONG.

79, Kirkdale Road, Liverpool,
June 22nd, 1881.

New Bracelet Fastener.

The Patent Office teems with records of inventions and improvements in fasteners for articles of jewellery, but few of them have ever become commercially successful, simply because they did not stand the test when practically applied. A fastener, to answer all that is required of it, should be simple, durable, safe, and cheap. These indispensable qualities we find combined to a high degree in the New Patent Bolt or Duplex Fastener of Messrs. P. Vaughton & Sons, Great Hampton Row, Birmingham, which has already secured considerable popularity.

The bracelet to which the fastener is fitted has two small pieces of metal slightly projecting from the surface of the round. To open it, all that is necessary is to gently press the projecting pieces, when it instantly flies apart. The bracelet has a spring joint and a spring fastening. It is closed by merely pressing the two parts together, as two small latches yield to gentle force and slide into the apertures made for their reception. When inside, the latches spring back and firmly lock the two parts of the bracelet together. Nothing can be more simple, and at the same time more efficient, than this mechanism; and though subjected to severe tests, it has been found satisfactory in every respect; in fact, the fastener rather improves by use than otherwise, both in the evenness and safety of its working. Another advantage of this fastener is, that it can be applied to any bracelet.

Messrs. Vaughton & Sons, who are also well-known as manufacturers of medals and masonic jewellery of superior design and workmanship, have just issued a sheet of excellent designs, which shop-keepers would do well to secure, as it will enable them to submit for selection designs of medals for yachting, boating, cricketing, bicycling, &c., unsurpassed in style.

Book Notice.

Watch and Clockmakers' Handbook. By F. J. Britten. Kent & Co., Paternoster-row, E.C. Price One Shilling.

This is a Third Edition of this cheap and handy manual, by the esteemed Secretary of the Horological Institute. It contains simple rules for calculating conversions, lever trains, motion work, fusees, lengths of pendulums, clock trains, &c., with exhaustive tables of conversions, lever trains, motion work, fusees, expansion of metals, &c.; also directions for making zinc and steel compensating pendulums, and other useful memoranda. It is certainly the best shilling's worth we have in horological literature.

Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann, on Monday Evenings, from October 25th.*

(Continued from p. 166).

If a tooth and pinion leaf form contact before the line of centres, the resistance produced by this condition, and the power expended in overcoming it, may be termed engaging friction. It is one of the two causes of stoppage in depths, of which the clogging of teeth and leaves, by reason of insufficient clearance, forms the other. In escapements, the angle of contact is nearly bisected by the line of centres, and no great errors accrue from it; but in a depth, it is impracticable. The reason of the exception in the former we will consider in its turn; at present, we will confine ourselves to the conditions attending the engagement of a tooth and pinion leaf before the line of centres.

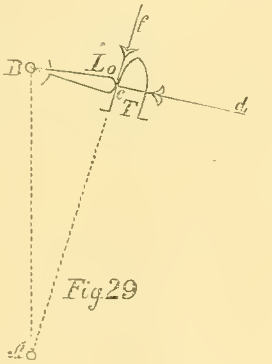

Fig 29

Let A and B (Fig. 29) represent the centres of motion of a wheel and pinion, and A B their line of centres. L represents a pinion leaf in contact with a tooth, T. Also, let B c A represent a maximum angle of engagement, equal $\angle$ 90°. Then $o\ f$, being the tangent to B o,† the pinion radius of contact, represents the direction of its motion at this instant, and $c\ d$ is the tangent to the wheel radius of contact, and represents the direction of the circumferencial force of the wheel.

Since the direction of $c\ d$ is in a straight line with B o, the circumferencial force of the wheel is exerting a normal pressure on the centre of motion B, and hence no amount of potential energy in the wheel‡ can communicate motion to the pinion.

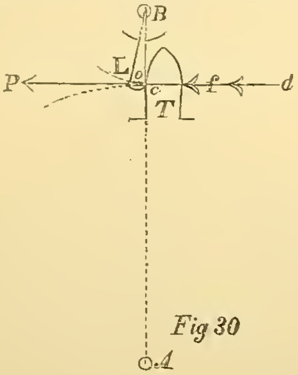

Fig 30

Again, let Fig. 30 represent tooth T, and pinion leaf L in contact at the line of centres A B; $o\ f$ or $c\ d$ is the tangent both to B o and A c, and therefore the directions of circumferencial force of the wheel and motion of the pinion at the point under consideration are both represented by $o\ c\ f\ d$, and since $c\ d$ is normal to B o, motion is communicated to the pinion without any surface friction, and therefore without any loss of power. Hence we have the condition of a force, P, acting at right angle to a lever arm, B o, while Fig. 29 represents a force acting in the direction of the lever arm.

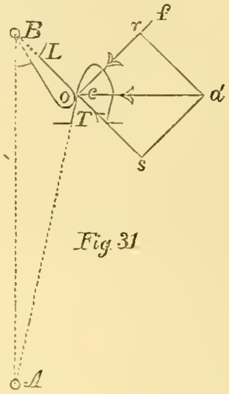

Fig 31

And also let Fig. 31 represent the point of contact at some intermediate position of those shown in the other two last figures; $o\ f$ and $c\ d$ represent again the directions of the angular motion of the pinion, and the circumferencial force of the wheel.

It is evident that angle B o A increases in magnitude as angles A B o or B A o diminish, and that the angle formed by the tangents $o\ f$ and $c\ d$, also diminishes in the same ratio as B o A increases, because B o A + $f\ c\ d$ are always equal to two right angles.

Let $c\ d$ represent the magnitude of the circumferencial force of the wheel, as well as its direction. From d, drop a line parallel to o B, meeting $o\ f$ in r, and complete the parallelogram, $o\ r\ d\ s$. Then, according to the principle of the parallelogram of forces (see page 99, Vol. VI.), $r\ o$ and $s\ o$ are the components of $o\ d$ or $c\ d$. Neglecting friction, and conditional that the contact takes place at the origin of the addendum, $o\ r$ represents the resolved part of $o\ d$, available to turn the pinion about its centre, and $o\ s$ the resolved part of $o\ d$, which is exerting a normal pressure on B. A comparison of Figs. 29, 30, and 31 will show that, as $\angle\ d\ o\ f$ is always equal to B A o + A B o, $o\ r$ must diminish, and $d\ r$ or $o\ s$ increase, as the angle of contact before the line of centres becomes greater.

Thus, in Fig. 29, $r\ d$ becomes equal to $o\ d$, and $o\ r$ vanishes; therefore, the whole of the circumferencial force of the wheel is expended in normal pressure on B, and hence there is no tendency whatever to turn the pinion about its centre. Again, in Fig 30, $o\ r$ becomes equal to $o\ d$, and $r\ d$ vanishes; hence the whole of the circumferencial force of the wheel is expended in turning the pinion about its centre, and no force is exerted in the direction of o B. We have proved, therefore, that the power communicating rotary motion to the pinion varies in an inverse ratio to the angle of contact of a tooth and pinion leaf before the line of centres.

To strip the problem of as many points of difficulty as possible, we have neglected friction; that is, considered the surfaces in contact perfectly smooth, and also considered the pinion leaf to form contact with the tooth at the origin of the curve.

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* All rights reserved.

† If a perpendicular is drawn to the point where the radius cuts the circumference, that line is called the tangent to the radius.

‡ Force stored up.

In practice, these conditions are not available; therefore it is necessary to notice them. If in Fig. 31 we take friction into account, the limiting angle of resistance must be added to $d\,o\,f$, which will then diminish $o\ r$, and increase $d\ r$. The co-efficient of friction plays an important part in depths. It is a matter of experience that a watch will go with a bad depth, while the pinion is new or the surfaces smooth; but as the polish wears off, the co-efficient of friction increases, there is more power wasted in overcoming friction, and less available to turn the pinion about its centre: hence the watch or clock stops. Again, if contact occurs in any point outside the origin, $c\ d$ is represented by the normal of the tangent drawn to the point in the curve under consideration. It follows from this that since the distance of the point of contact from the origin is proportional to the angle of contact, and the angular variations of this normal is in a progressive ratio, as o A increases, that $r\ o$ must vanish long before the position shown in Fig. 29 is reached, or that the resistance to angular motion of the pinion, or a tendency to stoppage increases in a progressive ratio with the increase of the angle of contact before the line of centres.

To analyse these exact ratios would form a useful and instructive exercise, but we shall have to pass by it for the present.

Disengaging Friction.

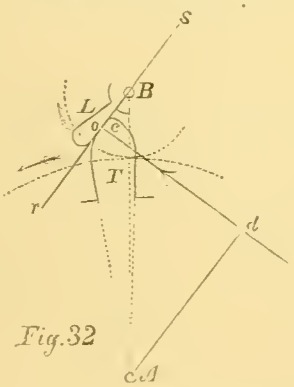

Fig. 32

Let Fig. 32 represent a wheel and pinion in contact past the line of centres.

The c point of contact is o; and o B or $r\ s$ is a tangent drawn to point c in the curve of the addendum. To this $c\ d$ is the normal, and represents the direction of the pressure on the pinion leaf o B, and A d is the virtual lever arm. Since in a lever the moment is the product of the length into the power, and as therefore a shorter lever arm will maintain equilibrio with an increased power, it is evident that as A d diminishes the power communicated to o B must increase. But, again, the pinion radius of contact is diminished. In Fig. 32, the pinion radius of contact o B also forms the normal to $d\ c$, and the virtual lever arm of the pinion. Now, it admits of proof, that with an epicycloidal curve, the virtual lever arm of the wheel varies as the virtual lever arm of the pinion, and therefore until the point leads the conditions shown in Fig. 30 are maintained.

In low-numbered pinions the point of the tooth leads through a great part of the angular engagement past the line of centres. The higher the addendum, the greater the pinion surface over which the point slides. This will account for the fact that Geneva escape-pinions as a rule wear more than English lever or verge escape-pinions, because the addendum of the latter wheels gearing into them are more rounded, and hence lead part on the flank, whereby the pinion surface of contact, and hence wear, is diminished. When the point of a pinion leads, the conditions under which motion is communicated to the pinion become changed.

Let Fig. 33 represent the point of tooth T in contact with pinion leaf L at o. Let $o\ d$ represent the circumferencial force of the wheel, and $o\ r$ its magnitude. $o\ s$ is the direction of the angular motion, and the direction of the reaction on the pinion face. B $o\ r$ is, therefore, resolved into two forces, viz., $o\ s$ the force communicating motion to the pinion, and $o\ c$ the pressure on the wheel centre A.

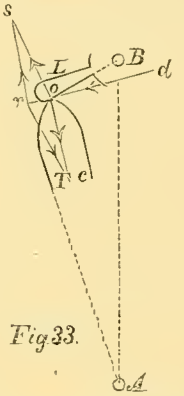

Fig. 33.

It is evident that under these conditions the pressure on the pinion is very great, and as friction is proportional to pressure, this will account for the exceptional veer in low-numbered pinions.

The practical deductions of these considerations are, that high-numbered pinions are much more advantageous than low-numbered, because, first, the curve leads, as has been shown, and, secondly, since the sliding friction increases in a progressive ratio as the magnitude of the angular engagement between one tooth and the corresponding pinion increases, the surface over which contact by sliding takes place is much less in high-numbered than low-numbered pinions.

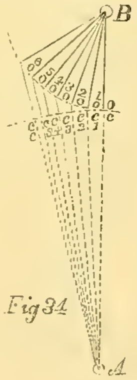

Fig. 34

Let o B, o^1 B . . . . o^6 B represent seven consecutive positions of the pinions during the angle of contact, $o\ B\ o^6 = 60^\circ$, and also let c A . . . . c_6 A represent the corresponding wheel radii to the points of contact, then $o\ c$, $o^1\ c_1$, $o^2\ c_2$ . . . . $o^6\ c_6$ represents approximately the measure of the sliding contact. $O^1\ c^1$ and $o^2\ c_2$ represents it very nearly, but as $o^3\ c_3$ . . . $o^6\ c_6$ represents the distance of the point of contact from the pitch circle of the wheel, and the contact takes effect along the curve, it follows that the sliding-surface contact is in excess of the lines $o^3\ c_3$ . . . $o^6\ c_6$. It is evident, therefore, that in o^3 B o, which is an angle of 30°, and therefore represents the angle of contact of a pinion of 12, we have less than one-third of the surface-sliding action than we have in o^6 B o, which is an angle of 60°, and represents the angle of contact of a pinion of 6; hence it is proved that high-numbered pinions are preferable to low-numbered ones.

(To be Continued.)

Trade Notes.

Jewellers need not be at a loss for novel designs as long as the present fashion of turning every living and creeping thing into an ornament prevails. The idea, like many other absurdities in the way of dress and ornament, comes to us from Paris; but as it has no artistic merit, it is not likely to secure a permanent place. Of course, gems, real and imitation, play the principal rôle in these ornaments, and every pet flower of fashion is copied in the shining crystals, besides the crab, lizard, beetle, owl, and eagle. Butterflies, peacocks, and even frogs, look nice when decked out with suitably arranged gems. The latter animal enjoys special favour—a proof of the origin of the fashion; but as we are not a frog-eating nation, our jewellers will do well to supply us with something more British. If the unsightly lizard can, with the use of gems, be made a fit ornament for a lady, why should not also the griffin of Fleet Street, which, thanks to Mr. George Augustus Sala, has been promoted to the rank of dragon. "Temple Bar" brooches might prove a good line to an enterprising manufacturer.

* * *

A new brooch displays the word *Porte* in crystal letters, as a graduated background to a bar of dead gold, whereon *bonheur* is inscribed in black letters.

* * *

Padlocks have long been pendants for bracelets and necklaces, but it is only lately that the idea has been completed by the addition of a tiny key, which is either placed in the keyhole or left dangling from its gilded chain. This is also repeated in the oval lock and key lockets of plain whitened silver.

* * *

The Exhibition at Chaux-de-fonds (Switzerland) of watches and watch tools and machines, to be held during the present month, promises to be a success, no less than 400 manufacturers having applied for space.

* * *

A large new clock has just been erected in the parish church of Ashover, Derbyshire. It strikes the hours upon a 13-cwt. bell, chimes the Cambridge quarters upon four bells, and shows time upon a skeleton dial, 4 ft. 6 in. diameter. The movement has been fitted with all the latest improvements to ensure accuracy of performance. It has apparatus for continuing the action during winding, a small internal dial on the clock movement indicating the time shown by the external hands. Wire ropes carry the weights. The work has been carried out by Messrs. Smith, Midland Steam Clock Works, Derby.

* * *

A large new clock has been erected in the new cemetery, Intake Road, Sheffield. It strikes the hours upon a 17-cwt. bell, chimes the ding-dong quarters, and shows time upon two illuminated dials, each 5 ft. 6 in. diameter: the movement is fitted with all the latest improvements. It has a "Denison's double three-legged gravity escapement," and a pendulum of 2 cwt. Apparatus is also attached to turn up and down the illuminating gas. This clock is also from the works of Messrs. Smith, Derby.

* * *

An improved gauge for bracelets has been patented by Mr. Willis H. Howes, of New York. The object of this invention is to readily ascertain the exact size and form of bracelet required to fit any particular wrist. The invention consists in a gauge for bracelets that can be readily contracted and expanded to fit a wrist, and thus give the exact form and size of bracelet required to fit the wrist.

The number 197·2 is generally accepted as the atomic weight of platinum, but Herr Seubert has very recently shown, in the *Berichte* of the German Chemical Society, that this number is probably too high. As the mean of thirty-nine closely-agreeing results, Herr Seubert obtains the number 194·46. If this number is accepted, the atomic weight of platinum is less than that of gold.

* * *

The Prince of Wales has accepted the office of President of the City and Guilds of London Institute for Technical Education. Her Majesty's Commissioners of 1851 having signified their approval of the plans of the building prepared by Mr. Alfred Waterhouse, the Prince of Wales has consented, in his capacity of president, to lay the foundation stone of the Central Institution at South Kensington during the present month.

* * *

Budapest, the capital of Hungary, presented to Princess Stephanie, on the occasion of her marriage with the Austrian Crown Prince, a piece of goldsmith's work worthy of special notice. It consisted of a complete set of ornaments as worn by Hungarian Ladies, when in national costume. The remarkable necklace of Isabella Zapolya, now in the archæological collection of the National Museum, served as pattern. The richest piece of the set is a belt, formed of four rows of oval linked, and white and blue enamelled gold-chains, interrupted by ten medallions, the tenth forming the clasp. Each of these medallions, square in shape, have white and blue enamel surfaces, with an opal surrounded by four brilliants in the middle; the one forming the centre of the belt is larger than the others, and is decorated by the arms of the city, with rubies above and below, and two figures of angels on either side, each again surmounted by a dove with spread wings. Next in importance ranks the necklace. It consists of 63 oval-shaped links richly decorated with gems and enamel, the links being connected by a fine gold chain; it is very long, and goes several times round the neck. To the middle of necklace, an ornament is attached which can also be worn separate, as a medallion, and this ornament carries the principal gems, brilliants and two rubies. In the centre are the Belgian arms, with angel figures on both sides. Six pairs of buckles, a pair of earrings, and five hair-pins, complete the set. Gems used: 4 rubies, 303 opals, 1,100 diamonds. Cost, 50,000 florins.

* * *

Eugene Patereau, aged 32, a hairdresser, living in Greek Street, Soho; Alexis Lindais, aged 31, a bootmaker, of 82, Wardour Street; and Marguerite Hoveri, aged 30, a dressmaker, were brought up in custody, charged before Mr. Flowers, on an extradition warrant, with being concerned in a burgarly committed at the shop of M. Sturbell, 11, Rue des Fritsien, Brussels, when jewellery to the value of between £8,000 and £10,000 was stolen. A gold ring set with the human teeth of the proprietor's child was particularly mentioned for the purposes of identification as one of the articles stolen.—M. Albert interpreted.—Inspectors Marshall and Langrish went to the Clerkenwell-road on Wednesday, and kept observation on No. 19, which is occupied by a tobacconist. They saw the two male prisoners go in, carrying a small white parcel, which they left, and came out again with a brown parcel. They were taken into custody, and it was subsequently ascertained that the parcel left at the tobacconist's contained jewellery amounting in value to upwards of £4,000. The jewellery was now produced by Inspector Greenham, and was of a very beautiful description, including some very costly bracelets of sapphires and brilliants, rings, pendants, brooches, &c. Some of the property was found by Sergeant Moser at the address given by Lindais. Two diamond pins, five loose brilliants, sapphires, gold chains, diamonds, and cat's-eyes were found concealed among the stuffing of the cushions, and some parcels of jewellery were discovered hidden in the couch. The female prisoner was present, and was taken into custody.—The prisoners were remanded.

A French Company, the Société Française d'Inoxidation, is carrying out, on a large scale, Mr. Bower's process for protecting metals against the oxidizing influence of a damp atmosphere. The coating of the iron articles is produced by first cleansing their surfaces, and then by heating them in a furnace to a light red heat, when successively currents of carbonic oxide and carbonic acid are passed through it. In this way a bluish-black oxide of iron is found upon either cast iron, wrought iron, or steel. This oxidized surface, on being polished with oil, takes a beautiful lustre, and it is further ornamented by scraping some parts of it free from the coating, which are then either covered with a thin layer of bronze, gold, or platinum, by galvanic action, after the invention of M. Dodé. Many articles made by the Société d'Inoxidation, such as statues, vases, fountains, basso-relievos, candelabra, &c. are really of a very beautiful appearance. The works of the company are at Val d'Osne, (France).

Upwards of 1,200 awards have been made to British exhibitors at the Melbourne International Exhibition; 882 are accompanied by medals representing the highest order of merit. Of these medals, 186 are gold, 483 silver, and 213 bronze.

Among the wedding-presents of Miss Nelly Baldock, was a large silver-mounted dressing-case, formerly made for the famous Count D'Orsay, by West, of St. James' Street, at the cost of 800 guineas. When the Count fell into pecuniary difficulties, he honourably returned it to Mr. West, as he had not paid for it. As a proof that subjects from insect life are now in great favour for personal ornaments, we may mention that two bee brooches set with diamonds, a pearl fly brooch, a diamond fly, and pair of pearl fly earrings were presented.

We are informed that the Jury of the Horological Section at the Melbourne International, have favourably considered an appeal by Mr. D. Buckney, of 11, Southampton Row, Holborn, and raised their award on his exhibit from the third to the second order of merit. Anybody acquainted with the high-class work of this manufacturer, must admit that nothing more than bare justice has been granted to him. We know that Exhibition Jurors are not infallible, and we are glad that in this instance they have been generous enough to admit a mistake and rectify it.

A very marketable line of going barrel watches, made on the interchangeable system, is now being offered by Messrs. Radges & Co., of Argyle Works, Butts, Coventry, and of 53, Hatton-garden, London, E.C. They are made in all sizes, both in full and three-quarter plate, in gold and silver cases, and are, indeed, very nicely constructed, and cheap. We are pleased to see that our manufacturers begin to move with the times, and adopt modes of production which alone can enable them to turn out classes of goods suitable for the present market, both in price and style.

Mr. F. R. Winterburn, jet manufacturer, of 14, Silver-street, Whitby, recently submitted to us a number of the best class of jet lockets, with monograms, made to the order of a leading London house; and we must admit that they are a credit to the manufacturer. The general thinness of the locket, the clear and graceful outlines of the well-designed and well-carved monograms, and the closeness and neatness of the fitting, give these goods a light and most elegant appearance.

Awards at the Melbourne International Exhibition.

WE extract the following from the *Melbourne Argus*, the leading daily paper of that city, under date May 3rd ult.—

"An important result was arrived at by the Executive Committee yesterday in regard to the medals to be given in connection with awards obtained for collective exhibits, *i.e.*, the joint exhibits of a number of individual firms or companies. In certain cases manufacturers have combined in order to produce a good impression on the public, and to make sure of one or more high-class awards. Obviously, however, it would be unfair to manufacturers who had sufficient confidence in themselves to enter the competition singly, to pit them against a host of opponents collected into one solid body. The Executive decided that collective exhibits of the kind above described should receive service medals, and that gold or silver medals should only be given to individual exhibitors. For example, the watchmakers in the Swiss court (32 in number) entered their goods as one exhibit, and by this union of forces—the nice workmanship of one, the time-keeping qualities of another, &c.,—won first-class honours. Against them there competed individual exhibitors from England, France, Victoria, the United States, &c., and out of this number only the Waltham or American Watch Company obtained an award equal to the one gained by the combined Swiss makers. The combination will receive a service medal (the class of medal awarded to Governments, public departments, and commissioners), and the individual exhibitors a medal of the quality watches are considered worthy of. Had the same kind of medal been given to both parties, each of the 32 Swiss exhibitors might have been entitled to say he had won the gold (or silver) medal, though as a matter of fact the prize was only given for the best article in the whole collection. For the sake of the Swiss exhibitors themselves, it seems a pity that they did not enter the competition in the same way as the rest of the world, and thereby carry off 32 individual awards (if entitled to them) instead of one only, which none of them can claim as his own, because his share in it at most can only amount to one thirty-second part."

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Melbourne International Exhibition, 1881.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—I am advised that the Jury of the Horological Section have raised their award on my exhibit from the Third to the Second order of merit.

I can only regret that it should have been necessary to appeal and call in an expert to convince the Jury that they had done me an injustice.

I am, yours &c.,

11, Southampton Row, Holborn, W.C., D. BUCKNEY.
June 29th, 1881.

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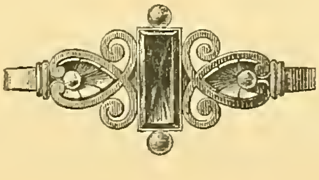

Construction of Timekeepers.

DELIVERED TO THE BOARD OF LONGITUDE, MARCH 7, 1805.

ARNOLD'S TIMEKEEPER.

HAVING in previous numbers reproduced from *Smith's Compendium of Practical Inventions* (Liverpool, 1816), Earnshaw's answers to the questions put to him by the Board of Longitude in reference to his timekeepers, we now reprint from the same source the questions and answers relating to Arnold's time-keeper, supplied by his son. From the description which was deposited with the Board of Longitude, we cull the following remarks about the balance-spring.

"The balance-spring may be made of steel-wire hardened and tempered," of steel-wire hard-rolled, or of gold-wire alloyed with copper. Steel-wire hardened and tempered is the most elastic, then gold, and lastly steel-wire hard drawn. Springs composed of any of the above substances, if the materials be good, will answer the purpose. The quantity of copper-alloy put to the gold has been found to answer in the proportion of from one-eighth to a quarter; and many other proportions may probably do as well.

The form of the spring is helical, or cylindrical, except for a portion of the turn at each end, where it is curved in, and fastened at an equal distance between its centre and circumference. Were not those turns curved inwards, but left of the same diameter with the others, the spring would not have its easy, concentric motion; but, on the contrary, would jolt, wabble, and be distorted. Whether the balance vibrates an arc of 230 degrees from its point of rest, in its forward direction, or re-vibrates 230 degrees in its backward direction, making together 460 degrees,—the cylindrical figure of the spring is still preserved. Upon the length of this spring depends the isochronism of the vibrations of the balance; and in every spring of a sufficient length, there is a place where all the vibrations, long, short, and intermediate, will be performed in equal times. When the timekeeper is first set going, and always immediately after cleaning and putting into good order, the main-spring pulling with all its force, the oil applied to the pivots clean and good, and every part performing its functions to the greatest advantage, the balance may vibrate from 180 to 230 degrees from the point of rest, according to the power of the main-spring, and the relative weight of the balance. The balance also re-vibrates on the other side of the point of rest nearly the same arc, but here the vibratrion is only reckoned on one side.

From continual exertion, the main-spring will undergo some diminution of its original power; and very great resistance will be created from the thickening of the oil, and from the accumulation of dirt: so that at the end of a long voyage, suppose three or four years, the arc of vibration of the balance will gradually decrease from 230 to probably 130 degrees, and so on; till in time it will come to rest. From which it must be evident, that if the different arcs from 230 to 130 are not all performed in equal times, a great irregularity must, from that cause, take place. If the large arcs are performed in longer time than the small ones, the timekeeper will accelerate, or go faster and faster: and if the small arcs are performed in longer time than the large ones, it will retard, or go slower and slower. To adjust the long and short arcs, let the timekeeper, when clean, and the balance vibrating to its greatest extent, go for a few hours; and then, without stopping it, by means of the click and ratchet above the barrel-cap, and a key applied to the barrel-arbor square, let the main-spring down a turn or two, till the arc of vibration decreases from 230 to 130 degrees, or thereabout. Then let it go for the same time as before, and if it goes slower with the long arcs than with the short ones, which is generally the case, shorten the spring, by drawing it through the lips of the stud. Then try it again in the same manner, and so on, till they are performed in equal times.

If, on the contrary, the short arcs should be preferred in longer time than the long ones, or the long arcs be performed in less time than the short ones, which amounts to the same thing, the spring must be let out, or lengthened at the same stud, and so on repeatedly, until they correspond. If, after letting out the spring several times, there should be no more to spare, a larger spring must be made. If the spring is made of hard, rolled wire, and the construction should be such as not to leave room for a spring of the usual length, and one much shorter than ordinary should be required, it will be very liable to be overstrained; and if hardened and tempered, or of gold, to break. It will, however, be a good deal relieved and assisted by tapering.

Q. Are all these three substances (steel-wire hardened and tempered, steel-wire hard rolled, and gold-wire alloyed with copper) equally good and applicable in all cases to box and pocket timekeepers? Or under what circumstances are they to be separately applied? And what advantage arises from applying one in preference to either of the others? Does not flatting or rolling pendulum wire destroy its elasticity, by crossing the grain of the wire so rolled? If so, do you use any means of making the grain of the wire longitudinal?

A. All these three substances may be equally applicable in all cases to box and pocket timekeepers. Springs made of gold and of tempered steel are attended with more trouble in manufacturing than those of hard-rolled wire, and unless the gold is well compounded, and drawn or rolled perfectly sound, it is liable to break. In springs of tempered steel, the greatest care should be taken that they are, in the first place, hardened from end to end, and then they may be equally tempered throughout. They will be more elastic than gold, and perhaps better, excepting their liability to rust. Springs of hard-rolled wire are the least elastic of the three, and are subject to lose their elasticity, if made so short as either of the others may be. On this account, I leave them about a fourth part longer than the others; and if the material be good, they will stand. They are made in less time, and with less trouble, than either of the others, but liable to rust. I do not know that flatting or rolling the wire destroys or impairs its elasticity, nor do I use any means to make the grain of the wire longitudinal.

(*To be Continued*).

THE COVENTRY DIRECTORY.—Messrs. Curtis and Beamish have sent the Coventry Directory for 1881, and we can cordially recommend it to every person who has the most remote connexion with "the city of the three tall spires." The contents consist of a plan of the city, an introductory notice of its antiquities, particulars of the public buildings, and the various institutions, trades, charities, societies, &c. Those are followed by details about the Corporation, and the work is concluded by the usual directory proper in the way of names, streets, professions and trades. Mr. Wigston, the compiler, has done his work in a praiseworthy manner.

The Discrimination and Artistic Use of Precious Stones.*

By Professor A. H. Church, F.C.S.

(Continued from page 167.)

RED STONES.

BEFORE other coloured stones the ruby may be fitly considered. It, with the sapphire, and all the transparent varieties of corundum, ranks next to the diamond in hardness. It, is, moreover, a stone of great beauty. Probably the experts in jewels are right in assigning the highest value to those rubies which possess a "pigeon's blood" colour—this is the orthodox hue. But the paler colours, and those which verge upon pink and crimson, and even violet, are capable of being so treated by means of association with white and black enamel, or with dark stones, like olive-green tourmalines, as to lend themselves to the production of very beautiful decorative effects. The great mistake commonly made in the treatment of the paler rubies, lies in the attempt to treat in the same way as the deeper-coloured stones.

It is difficult to describe the peculiar colour-quality of the ruby in words. In fact, our nomenclature is neither ample nor accurate. Our appreciation of delicate differences between colours is growing, but the language by which we endeavour to describe the hues which we have learned to appreciate is either stationary, or else receives additions from time to time from the caprices of French fashions. The time has really arrived when a standard series of hues of all sorts should be constructed and appropriately named; but, in the case of the ruby, the question of pleochroism comes in, and renders the difficulty of describing the colour-quality of this stone greater. There is also some prismatic "fire" in the stone, and much internal reflection of light, while its surface lustre lies between resinous and vitreous. These four properties give to the red of the ruby a peculiar richness, which the two other species of precious stones—the spinel and the garnet—which come nearest to it in colour, do not equally possess. The two reds which make up the colour transmitted by the ruby do not differ much, but yet they help to impart, to a properly cut stone, a delicate variation of hue which is not present in any other red stone, nor in any other imitative substance. The dichroiscope, consequently, never fails to discriminate between a ruby on the one hand, and a spinal or a garnet on the other. The two latter stones are, of course, softer than the ruby, and the former is always lighter—that is, of less specific gravity. For the ruby, and the whole of the corundum family of stones, have the specific gravity of 4, and a hardness which is nearly, and in some cases quite 9, on the mineralogical scale.

One of the happiest uses of the ruby is in the form of an inlay, in certain gold vessels of Indian origin. The external surface of these vessels is covered with a system of interlacing ridges and furrows. The rubies, generally small, oval, and cut *en cabochon*, are set along the furrows. Thus they are much protected from the chance of dislodgement, while the effect they produce, of a rich deep crimson groundwork over which a gold netting has been thrown, is in perfect harmony with the materials and their workmanship. For, naturally, the metal gold, when pure, or nearly pure, throws a ruddy tint when light is reflected from surface to surface; witness the interior of gilt vessels. The same thing occurs in the golden furrows of which we have spoken, where the rubies seem to rest in a golden sheen, of a hue in which the yellow, and orange, and red elements, now one and now another, appear to prevail. The gold should not be burnished where much contrast between the metallic surfaces and the rubies is desired; but the stones themselves should be as brightly polished as possible, in order not only to develop the full beauty and variety of their colour, but also the very considerable surface lustre which the ruby possesses. There is another kind of Indian jewellers' work to which most of the remarks I have just made apply. A perforated plate or disc of delicate arabesque or radiated work is found decorated with ruby beads, round or oval, attached to the circumference of the ornament, or else introduced into its midst in concentric circles. Here dull, dead or "matt" gold is particularly appropriate, as affording a pleasant contrast to the rich, smooth, and soft transparency of the rubies, which, from the manner of their mounting, may be looked through. The refinement of the slender goldwork, which, in this class of jewellery, approaches the delicacy of filagree, sets off by its minuteness of detail the simpler and bolder forms of the plain, smooth, rounded stones, which give it colour and warmth. I must dwell for a moment or two upon another Eastern method of dealing with the ruby. I refer to the use of this stone as an inlay or onlay—that is, an incrustation—upon jade, both white and green. It is not so much here a beautiful contrast of colour that is attained, although the greenish grey or olive green of the jade enhances the redness of the ruby; but it is a contrast of textures, a contrast of surfaces, a contrast of translucencies. You see but a little way into the jade, though it is illuminated by a soft diffused light; but you see through the clear deep-toned rubies, with their flashing beams of crimson.

Now compare with these examples of the artistic employment of the ruby, the ordinary mode in which this stone is set by English jewellers. Look at the half-hoop ruby ring, with five rubies well matched in colour, and graduated exactly in size, set close together in a regular row. You see, perhaps, a little speck of gold appearing here and there at each end of each stone, but nothing is made of these pieces of gold. You accept them because you know they are necessary to hold the stones in their places, but you find neither invention nor beauty in these little bits of gold claws. In fact, they are frequently prepared by the gross, ready for the mounting of any stones, provided the shape of the latter be suitable. Rubies, sapphires, diamonds, garnets, and emeralds are all set in the same way, not an attempt being made to adapt the amount of gold surface or its form to the specific nature of each gem. But why should not some variety and some appropriateness of mounting be secured for all stones? How exquisite, and yet how strong, were the gold and enamel stones in the Cinquecento time in Italy. Let those patrons who desire the rather barbaric splendour of masses of rubies gratify their taste by means of jewels in which the setting is not seen at all. But surely a fine stone is worthy of a fine and originally designed setting—proportioning the latter in form, in amount of work and surface, and also in colour, whether red, or green, or yellow gold, or enamel, to the shape and the hue of the stone to be set. And even small stones become quite beautiful, when arranged with taste and judgment, in accordance with the conditions I have named, and with the further condition as to collocation of individual stones in accordance with their size and shape.

In pendants, and necklets, and lockets, and brooches, there is room for the expression of some definite and intelligible design. The mere alternation of rubies with diamonds in rows or chequer work may, in some instances, achieve all that is needed. But a design of more definite form may often be preferable, especially where the stones at one's disposal are of differing colours and sizes. Then one may construct a suitable bit of leafage or flowerage, duly conventionalised, in accordance with the nature of the available materials, into forms of more or less geometrical severity.

(To be Continued.)

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* A Lecture, delivered at the Society of Arts.

A New Railway and Traveller's Watch.

THE ENGLISH WATCH COMPANY, of Birmingham, brought out, some time ago, a new railway and traveller's watch of the respective 16, 18, and 22 sizes. Like their other watches, these instruments are made by the Company's now well-known automatic machinery. One of the 18's was left at this office for the inspection of such of the trade as might feel themselves interested therein. A goodly number have seen it, and, without repeating individual expressions, we can safely aver that there has been no stint of commendation upon the practical points of merit of these new candidates for public favour. The one that we have before us is an 18-size keyless crystal. The hand-setting stud projects through the edge of the dome, and rests on the flat of the middle part, the cover shutting down upon it. In setting the hands the watch can be held dial upwards in the left hand, the nail of the left fore or other finger pressing down the stud, whilst the right hand turns the button. There are no seconds. The dial is very attractive. So far from presenting that objectionable annular blur, through the heavily-painted figures seeming to run into one another, it will be at once seen that distinctness combined with boldness have been carefully, and, we are bound to say, successfully worked out. All the hour and minute marking has been very clearly done, and it must be a dim light, indeed, in which the time cannot be told at a glance. The case is a special white-metal amalgam, that is said to keep its colour well, and is so hard and "trying" to manipulate in the making, that, when finished, the cost between it and silver is very trifling. From what we have learnt, *steel silver* would be the most appropriate name for it. We hesitate to say the amount of pressure that these cases have stood under test without flinching; certainly, far beyond anything that sterling silver would bear, and, still further, far beyond anything that any "thump" in the pocket will be likely to give.

This alone will be a great boon, not only to railway people, but to all travellers, and the many thousands of run-about, hurrying, business men—the hard-working rank and file of the busy world.

Having spoken of the case, we will now look at the inside. This is a full-plate movement with true compensation balance, sprung over, with best hardened flat spring, and jewelled in "two-pair." It is so "built" that, by taking off the name-bar the barrel can be lifted out without any further disturbance. The full-plate is held by good horological authorities to be the fittest kind for a class of watch in which hard work will form the lot of its existence. The reason given for that fitness is, that the diameter of the balance can be increased to the best possible proportions in the full-plate without any risk of being cramped for room.

It is only justice to say that we never saw a balance—even in the finest work—that gave better evidence in its light, beautiful play of being perfectly poised and sprung. The train is a 16,200, but we believe that 18,000 trains are made, and for those who desire it the Brequet-spring can be applied. This is not a sample watch got up to be only looked at for praise, but one of the "extras" of the five-hundred order, that was recently supplied for the use of the Indian State Railways. It has all the finish and action of a very superior instrument, and rises immeasueably above anything of the kind that we have seen turned out for travellers' use before. It is certain to make its mark in the world of watch-wearing horology.

Invention for Checking Tram-Car and Omnibus Fares.

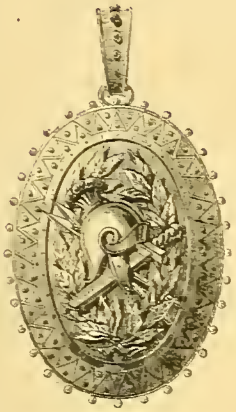
AN invention for checking the fares received by tram and 'bus conductors is about to be patented by Mr. J. Jerger, jeweller and watchmaker, at Devonport. Its full title is "Tram-Car and Omnibus Distance Teller and Fare Detector." It consists of a machine in a rectangular box, measuring 18in. × 4in. × 8in. In the interior is a stamping machine, such as would be used by a broker for stamping telegrams. There is a time and distance measurer combined, and this enables the apparatus to register the different moneys paid, so that at each break in the journey, the inspector—not the conductor—can calculate the amount of money that should have been received, and, of course, the number of persons travelling in the car. The various stations at which people get in and out of the car are also accounted for by little coloured balls being deposited in an ingeniously-contrived receptacle, parted off into divisions corresponding to the different stations of stoppage on the route. Thus, a certain place is reached in a given time, and at about that time one of the divisions already mentioned will have worked round by means of clockwork. The other part of the machine is made to work by the pressure it receives from passengers in stepping into the car. One of the steps consists of a spring-board, which, upon being pressed by the weight of a person, forces a spring, which, on moving a lever at the top of the apparatus, causes the stamping machine already alluded to to operate, and so register the number of distinct pressures the step-board has received, and, consequently, the exact number of persons who have entered the vehicle. These strips of paper with the different impressions are examined, together with the coloured balls, at the end of the journeys by the inspector, who will give a ready calculation of the number of passengers who have entered, and the amount of money received. Each tram-car would require an apparatus at either end of the vehicle, and, in the event of a person leaving the vehicle—say at Devonport, from Plymouth—there would be a Devonport division for the ball to fall into, while its colour would indicate where the person entered the car—both balls, of course, being placed in the funnel, the one given to the person entering, and the other by the conductor to each person leaving the car.

Mr. Jerger, who has been about four years in completing his invention, recently experimented with it at a local school, when he acted as conductor, the boys as passengers, and the head-master as inspector. It was found to work most satisfactorily. The apparatus will doubtless recommend itself to the companies, who at present suffer from dishonest conductors.

Description of Designs.

No. 1. Locket (Gold) of different Colours.
,, 2. Brooch of Coloured Gold, with different Coloured Enamels.
,, 3. Locket of Coloured Gold.
,, 4. Earring of Coloured Gold, with different Coloured Metals.
,, 5. Pendant of Coloured and Red Gold, Polished.
,, 6. Earring of Bright Polished Gold.
,, 7. Stud of Bright Polished and Coloured Gold.
,, 8. Stud.
,, 9. Seal, with Chain of Bright Polished Gold.
,, 10. Bracelet of Coloured Gold, with different Coloured Enamels.
,, 11. Seal, with Chain of Bright Polished Gold.

MONTHLY SUPPLEMENT OF DESIGNS.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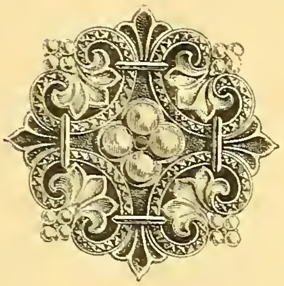
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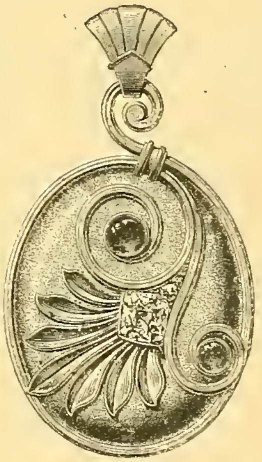
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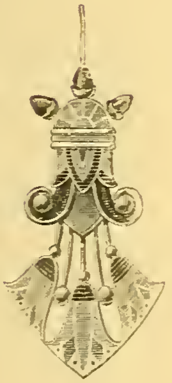
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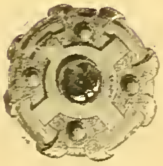
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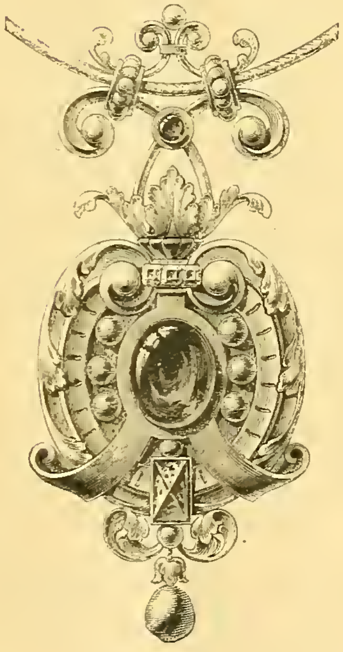
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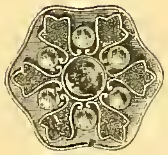
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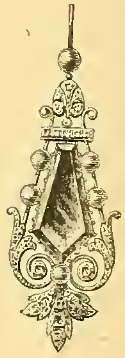
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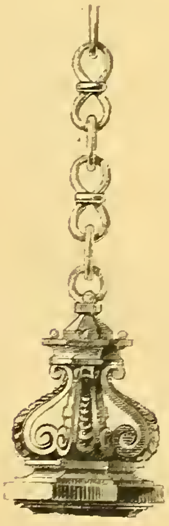
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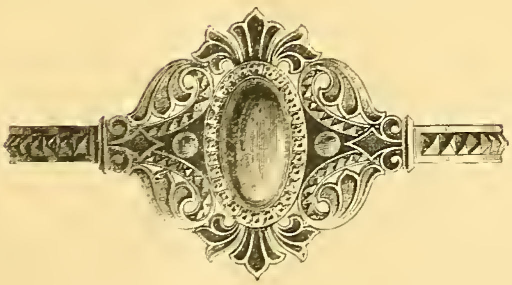
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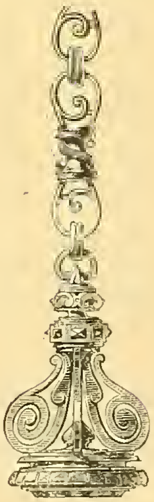
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For Description, see page 16.

Australian Diamonds.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—In answer to your enquiry, I beg to state that diamonds have been found in Australia for many years past, but their small size did not give much encouragement to searchers for the precious gem. Ninety-nine per cent. of those who emigrate to Australia, go there for other purposes than looking after diamonds; but there is no doubt that diamonds exist in large quantities in Australia. Some three years since I had a parcel of diamonds from Australia, found a few hundred miles from Sydney: they were quite different in general form to the Cape diamonds. The greater portion were quite round, and perfectly smooth on the outside, quite transparent, and colourless; others were of oval shape, so smooth on the surface that it gave no clue whatsoever to the line of cleavage. In polishing them, we found they were even harder in working than the Indian or Golconda diamonds. I have some specimens now polishing in my diamond cutting factory, which bear a different stamp to all others: they were, before cutting, quite smooth on the surface, and in form like the Indian rough diamonds: the outside was of a fine bronze colour, but when polished, is perfectly white and brilliant. I should be most happy to submit them to your inspection before sending them to the owners. They were submitted to the inspection of some of the largest African claim owners and diamond cleavers, and pronounced, before cutting, to be quite different in general appearance to the Cape diamonds. Evidently, those who have been fortunate enough to find the few stray stones, have not as yet come across the actual mine or mines, but have no doubt found stones which have been washed from distant surface-producing koppes, as was the case in some of the African mines. The finding of new sources would be a great boon, as the African mines have already got into the hands of monopolists.

I am, yours &c.,

WM. FORD.

Steam Lapidary Works,
8 & 9, Clerkenwell Green,
June 20th, 1881.

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Chatelain, Edmond, 26, Dorset Street, Baker Street, Watch, &c., Manufacturer. May 24. £500. Given to Sidney C. Buxton.

Rosenthal, Julius Loewe, 4, Southampton Street, Fitzroy Square, Silversmith and Jeweller. May 24. Settlement transfered from wife. Given to Solomon Benjamin.

Buckley, Alfred, 153, Anglesea Street, Aston, Birmingham, Jeweller. May 25. £50. Given to Edward Arm.

Herne, Charles, 16, Aytoun Road, Stockwell, Jeweller and Dealer in Fancy Goods. May 27. £100, &c. Given to Commercial, &c., Advance, &c., Bank.

Appletree, Isador, 38, Fitzwilliam Street, and Workshop at back of 29, Cavendish Street, Sheffield, Manufacturer of Electro-plate Ware, &c. May 30. £113, &c. Given to Samson Levi.

Long, William Henry, 62, Adam Street, Newtown, Cardiff, Watch, &c., maker. May 30. £42, &c. Given to Isaac Samuel.

Poulton, Robert, 10, Jury Street, Derby, Watchmaker, &c. May 30. £32 10s. Given to George Payne.

Perring, Henry Thomas Hewitt, 26, Marriott Road, Tollington Park, Manufacturing Jeweller. June 1. £20, &c. Given to Union Advance Company.

Evans, William, Bridge Street, Pontardulais, Glamorganshire, Watch, &c., maker. June 2. £14, &c. Given to William Usher.

Peace, Samuel, 2 Court, 3 House, Great Russell Street, Birmingham, Jeweller. June 2. £7 10s. Given to Hyman Lyons.

Smith, Thomas, 43, Milsom Street, Bath, Jeweller, &c. June 2. £3129 purchase money. Given to William T. Germain.

Mander, John, 45, Raglan Street, Coventry, Worcestershire, Watch-case Springer. June 3. £45. Given to Thomas Bannington.

Duryer, Albert Gambier, 35, Spencer Street, Goswell Road, Watch-dial Painter. June 3. £40. Given to John R. Rowland.

Hall, John, Victoria Street, Kilnhurst, near Rotheram, Yorkshire, Working Jeweller. June 4. £26 5s., &c. Given to Charles J. Hinchcliffe.

Vickers, Isaac, 49, Market Street, Lancaster, Watch and Clockmaker. June 8. £52, &c. Given to George Payne.

Grieshaber, Augustin, High Street, Pontypool, Monmouthshire, Watchmaker. June 10. £7, &c. Given to Aaron J. Jacobs and another.

Parker, John Robert, High Street, Little Walsingham, Norfolk, Watchhmaker and Jeweller. June 10. £22, &c. Given to Marks Feldman.

Hall, George Gray, 4, Spring Place, Milbrook, Hants, Working Jeweller. June 11. £32. Given to Francis Butler.

Smith, Charles Septimus, trading as C. S. Smith & Co., 30, Houndsditch, dealer in Cutlery and Plated Goods. June 11. £130, &c. Given to Maurice Jules.

Cowburn, Joseph, 57, Bridge Street, Sheffield, Silversmith. June 13. £6 15s., &c. Given to William Ashby.

Whitehouse, Thomas, Greta Terrace, North Marine Road, and 1, Market Street, Scarborough, Yorkshire, Jeweller, &c. June 14. £76, &c. Given to Commercial Discount Company.

Adams, Thomas, sometimes known as Thomas Widenham Adams, the Clock House, High Street, High Barnet, Watch, &c., maker, Optician, &c. June 14. £78, &c. Given to the National Advance Bank.

Barton, Robert Henry, High Street, Walton-on-Thames, Watchmaker, &c. June 14. £134 5s., &c. Given to Richard C. Trimm.

Eginton, John, 237, Cowley Road, Oxford, and 3, New Place, Woodstock, Oxon, Watchmaker. June 14. £45, &c. Given to Thomas Richards.

Weeks, James, Station Road, Haslemere, Surrey, Watchmaker, &c. June 15. £6 10s., &c. Given to John W. Sibley.

Wallen, Thomas, King Street, Coventry, Watchmaker. June 15. Indemnity. Given to John Linnett and another.

Lemoine, Janbatis Jules, trading as J. Lemoine & Co., 17, Great Sutton Street, Goswell Road, Clerkenwell, Gilder. June 15. £140. Given to George M. Taylor.

Makin, Peter, 86, Napier Street, Cemetery Road, Sheffield, Silversmith. June 18. £8, &c. Given to Joseph Cooke.

Darby, Charles, 9, Lower Brook Ssreet, Derby, Watchmaker. June 21. £13 10s., &c. Given to Lonis L. Beirnstein.

Blyth, William Christmas Timothy, Bridge Street, Norwich, Watchmaker. June 22. £104 10. Given to Stephen T. Amiss.

Horstmann, Frederick Gustav Adolphus, 13, Union Street, and 4, Vale View Place, Bath, Watch, &c., maker. June 22. Indemnity. Given to Frederick W. Purchase and others.

Weston, Thomas Shillcock, Chapel Street, Melton Mowbray, Watchmaker. June 22. £16. Given to Simeon Hart.

Waggit, John, 2, Tenter Street, Bishop Auckland, Durham, Watchmaker. June 23. £14. Given to Myer Cohen.

Quaife, William James, 48, Western Road, Tunbridge Wells, Kent, Watchmaker. June 23. £18, &c. Given to Moses Phillips.

Loughlin, Henry, 6, Lugsdale Road, Widnes, Lancashire, Watchmaker and Jeweller. June 23. £13. Given to Ellen Loughlin.

Shaw, John, 182, Victoria Road, Heeley, Sheffield, Silversmith. June 24. £14 5s., &c. Given to Samson Levi.

Crapper, William, 74, Charles Street, Hull, Watchmaker and Jeweller. June 25. £7, &c. Given to Marks Feldman.

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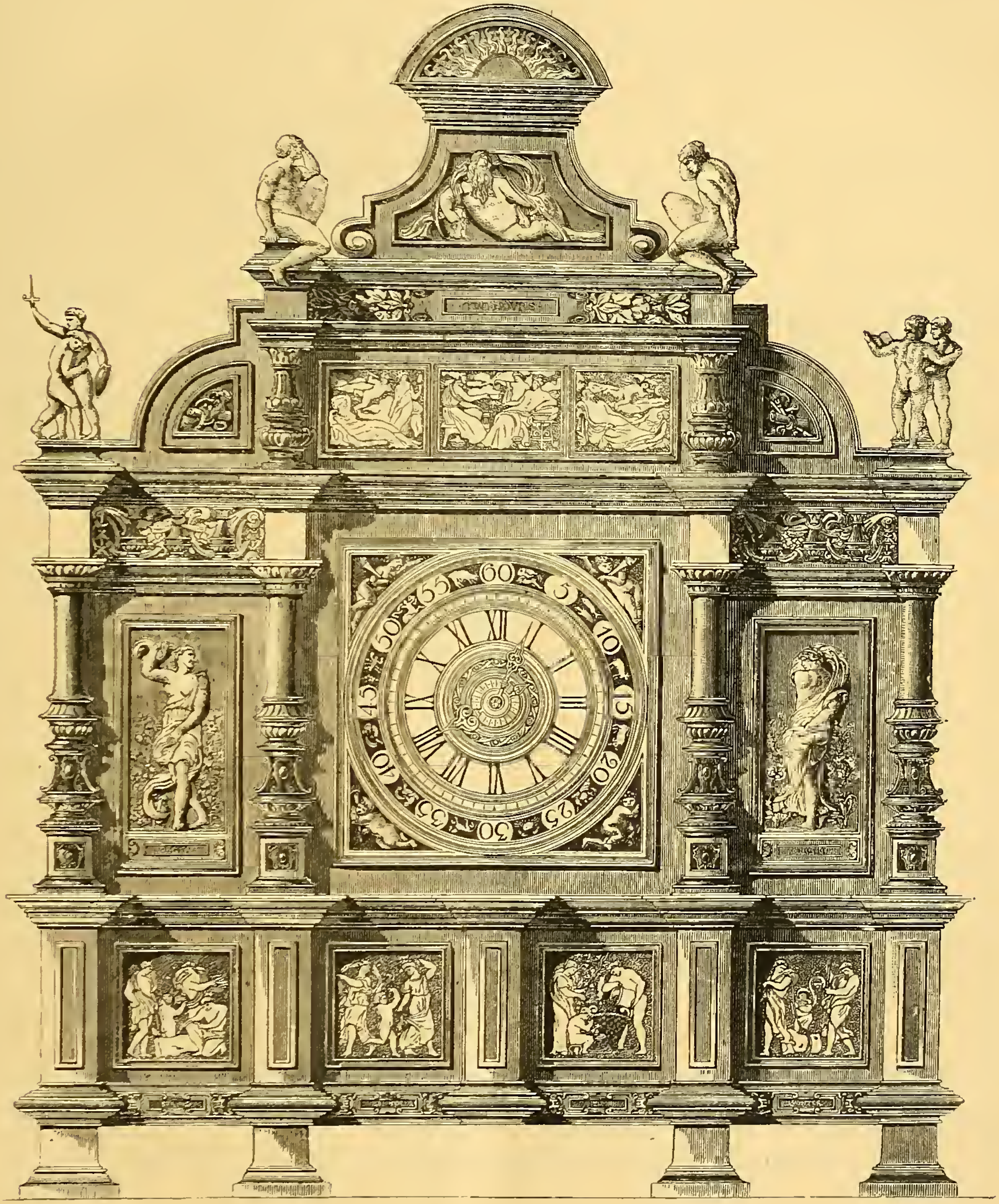
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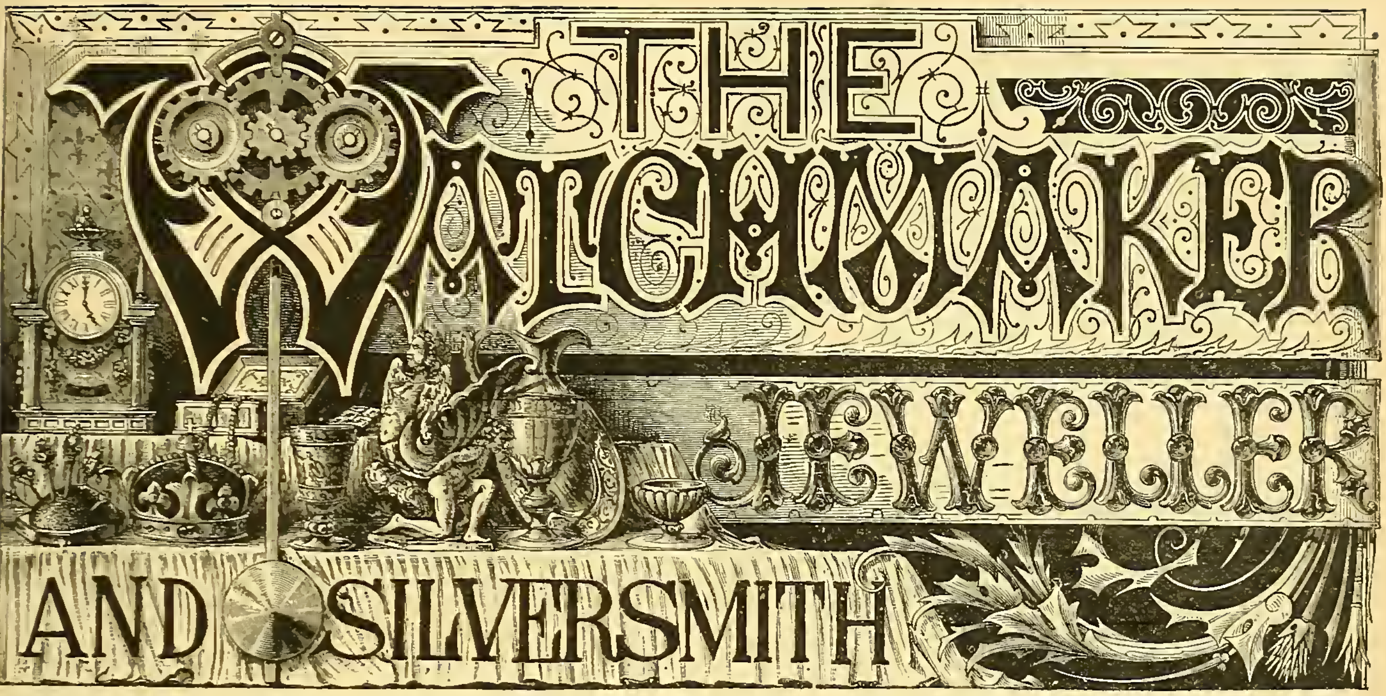

THE WATCHMAKER JEWELLER AND SILVERSMITH

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No. 75.—Vol. VII.] AUGUST 5, 1881. [Subscription, 5s. per Annum. Post Free.

English Keyless Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—There is, perhaps, no department in the English watch trade which has called forth so much display of ingenuity and contrivance as keyless mechanism, especially for fusee watches; and I have already stated in your pages that I attribute most of the important changes which have taken place in our system of manufacture to the almost universal adoption of the going-barrel, in order to simplify the arrangement for winding.

Keyless watches add greatly to the trouble of the examiner, and are a considerable hamperment to the old-fashioned adjusters, who have been trained to concentrate their attention on the actual going of the watch. In the good old days of key-winders they were their own masters, so to speak, after the movement had been fitted into the case and the adjustment of the fuzee and chain were satisfactory. Now, a number of vexatious hindrances are liable to arise in connection with the keyless mechanism, involving a continual removal of the dial and a consequent disturbance of the rate, in order to ascertain the cause.

Also, some known good rules are compelled to be disregarded: for instance, it is desirable for the pin which fixes the movement in the case to be placed near the balance, as has been already mentioned by M. Grossman; but in order to prevent injury to the winding pinion, the pins to a keyless watch are put on the opposite side, consequently the balance is pressed down last, often at a great risk of breaking the staff; and not only so, if the chain projects beyond the circle of the top plate, it is very likely to be turned over by the case. I have known several serious failures to have arisen from this cause.

It is a popular idea that a keyless watch should not require cleaning as often as a key winder; but this is scarcely correct, because the keyless work, being in constant action, requires periodical attention; the pinion is especially liable to fix in the pendant, and if any other part of the work becomes stiff a breakage may be expected. Under these circumstances, if the wearer is beyond the reach of skilled watchmakers, his safest plan is to wind with a key when possible until the watch can be properly attended to: in the meantime, he will have the satisfaction of knowing that the fault has not arisen through the rusting of the fuzee square and top pivot, which is often the case in key-winding watches, owing to their being wound with damp or dirty keys.

Arnold is credited with having made the first keyless watch used in this country, and I believe that either it or one of its contemporaries came under my notice a short time since. It was said to have been designed for the convenience of a naval officer who had lost an arm, and its construction was of a primitive description, there being no turning-back action and no means of setting the hands. The case only opened in front, and the watch-joint was at the IX., an ordinary bolt fixing the frame in the case. Something strongly resembling this case arrangement is now being advertised as an American novelty, but it only affords another illustration of the truth of the inspired proverb, that "there is no new thing under the sun."

When the general demand for keyless watches first arose (now some twenty-five years ago), there was, as there always is, a great difficulty in getting the work done in this country, and it was also a long time before the Lancashire movement makers roused themselves up to take the trouble to produce a really good going-barrel, with a sound stop work, and numbers of foreign movements were used on account of the superiority of the barrels, and, I may say, of the keyless work also. The foreigner, however, was not slow in seizing the advantage which this system gave him, and improved upon it by doing the whole of the work to the movements in imitation of our style. They were then placed in cases bearing the English hall-marks, and sold as genuine English. Thus the public are led to believe that a watch can be produced in this country at a certain price, whereas the cost of manufacture in Clerkenwell is quite 25 per cent. more than the advertised retail price.

The attempt to compete with these imitations has been the real cause of much of the discredit into which low-priced English work has fallen.

To quote the words of an American watch manufacturer, with whom I recently conversed, "this class of work has 'gone' from Clerkenwell." Whether it will ever return is a problem which will only be solved at the advent of a general revival of trade.

The keyless worker requires more than an average amount of intelligence; he should possess artistic ideas, and also be acquainted with the simple laws of mechanics, especially those relating to leverage. In these respects, mechanical engineers are in advance of watchmakers: for instance, the action of the bevelled wheels and pinions are often very imperfect. There are many interesting combinations of this mechanism to be seen at the South Kensington Museum.

Keyless work illustrates the relative advantages of machine work and hand-finishing, as well as any other branch of the business; the machine tool reigns supreme in the cutting of the wheels, which then require (in best work) to be thinned and adjusted by hand. Machinery is also useful in stamping out large quantities of rocking bars, springs, &c., of uniform sizes and patterns; but I have inspected show specimens of this kind of work, which, although smartly glossed on the top were very rough on the edges, and such as no trained workman could bring himself to pass.

Of course, when watches are required to be produced at a certain price to meet competition, there is no scope for this supplementary attention, which costs far more than the original materials, and if the manufacturers of such goods are fortunate enough to be ignorant of the defects of the finish, it is (for them) folly to be wise.

In my next communication I propose to give some practical hints relative to the construction of keyless mechanism, and also to refer to some of the best-known systems which are used in the trade.

I am, &c.,

JAMES U. POOLE.

33, Spencer Street, Clerkenwell, E.C.

P.S.—I am authorised by Mr. Curzon to repudiate the paragraph in your last issue, in which his name is mentioned—page 2, second column.

Soft Pinions and English Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—A sincere desire to see our English Lever Watch hold its own against foreign rivals, is my apology for troubling you again. The replies of Mr. W. H. Huddy and Mr. Thomas Armstrong to my previous letter, open up a larger question for discussion. Recently the watch manufacturers of Clerkenwell have been trying to discover the cause of the decline of the English watch trade. As a practical retailer, who buys only well-finished English and good Swiss watches (avoiding Americans), I, perhaps, may be permitted to say a few words upon the subject. One of the great drawbacks the English watch manufacturers labour under is in not seeing their goods again after they have been in wear a few years. If they had that opportunity, they would too frequently find the fusee top, centre bottom, fourth bottom, and, in small watches, third bottom pivots very much worn, and the case, by being made too light, with several bruises in it. If these defects were removed, I feel convinced retailers would have much more pleasure in buying and recommending them.

What I would suggest is, harder pinions and fusee steels, or every centre, third and fourth *bottom* hole being jewelled; and a proper *full supply* of oil being given to the barrel arbour, fused top, and centre bottom holes, by the method named by Mr. Armstrong, viz., to the pivots before the watch is put together. This plan of oiling I have adopted for many years, it being a common failing of examiners, as well as jobbers, not to put sufficient oil, and not putting that little on well to the large pivots that most require it. Frequently the hand work does not receive proper attention; it is not an uncommon occurrence to get a 16-size full-plate watch with the hands having as little freedom as to 6 or 8 size; the result is, the hands are never safely free of each other, although there is plenty of spare room between the glass and the end of the cannon pinion. A gauge should be made with the various heights of cannon pinion squares required by the various sized watches marked upon it, and the squares filed down to it. The cock jewelling is sounder with three screws to it when not sunk. The pendulum spring should be planted well up in the curb pins. The frames should be left as hard as possible by the gilder. The main wheel and barrel should in all cases be polished, instead of gilt, to prevent the possibility of their being softened, as the teeth of the former wear away rapidly if soft, and the latter splits open or gets out of shape by the breaking of the spring. Instead of a square hook being used for the spring, a good steel hook should be well tapped into the barrel; this saves the jobber time and trouble. The initials of all movement-makers should be stamped upon their movements, so that we retailers should have an opportunity of giving the watch manufacturers the initials on those movements we find wear best. If movement-makers, watch manufacturers, finishers, and examiners would each give these few simple details their careful attention, I think the goods they produced would be looked upon with more favour. The British workman must make up his mind to do his work conscientiously in every branch of the trade, as I fear no great revival of business can possibly take place until the blessing of two or three good harvests are granted to us; in the meanwhile, the foreigner is preparing to reap the benefit.

I am, your obedient servant,

J. D. FISHER.

228, High Street, Lincoln.

Machine Work versus Hand Work.

A Reply to Mr. James U. Poole.

(Continued from p. 2.)

No. VIII.

BEFORE any instruction is given to a youth in the mechanical operations by which a tool or any part of a watch is made, he should first be taught the theory and nature of the instrument to which he is about to give a tangible shape. This much-neglected branch of education is best taught in schools specially devoted to technical training, by means of text-books, models, diagrams, &c.; and no effort on the part of the teacher should be spared to make this knowledge complete; and the mode of imparting abstruse matters should be made as entertaining as possible. The teacher, like the preacher, must seek and find out acceptable words. The watchmaker who is a stranger to the ennobling pleasures of mechanical science may be said to have received a very imperfect education.

We find (p. 41, October number of this Journal) our young apprentice employed in making brass ferrules, and instead of storeing his mind with pleasant and useful memories, he is giving himself "many painful concussions," the sure precursors of failure, which entitles him to our commiseration rather than our rebuke. So far as we can gather, not a word has been said respecting the necessary power required in the ferrule to do the work, or the speed at which it may be accomplished. Not only are we left in the dark about the diameter—we are not even told whether the groove is to be **V**-shaped, rounding or flat bottom; but we are informed, "when a certain amount of proficiency had been attained in sawing off pieces of brass, they were then *hammered on an old flat-iron, minus the handle, which was placed between the knees.*" In this allusion to a cobbler's lapstone, does Mr. Poole contemplate our instruction or our amusement? I think the latter, and recommend the reader a hearty laugh.

"The squareness of sides were tested by holding the ferrule up horizontally and placing the edge of the graver over them." This absurd practice still prevails. The youth ought to be instructed to make a straight-edge, such as is used by engineers. The edge of a graver is never perfectly straight, and when it is used as a test, it produces a wrong impression in the mind, and you may regard a piece of work as perfectly flat when it is out of flat.

Mr. Poole writes: "The foregoing details may seem trivial; but, just as in the squad drill of a recruit lie the principles of the movements of an army in the field, so it is necessary to be thoroughly well-grounded in these first principles of filing and turning." Here, again, we have an apt illustration of the whole case, and I cannot resist the temptation of enlarging upon the analogy suggested. Beyond all doubt, "it is necessary to be thoroughly well-grounded in the first principles of filing and turning," and I am unwilling to regard as "trivial" any details that lead to so desirable a result. But the misfortune in English watchmaking is this—we never go beyond "these first principles."

In military matters, a squad drill implies a higher training and practice, just as the laying of a foundation presupposes a superstructure: such, however, is not the case in our ideas of watchmaking, as we regard the foundation as the end of the matter. Suppose, for example, we were to train our soldiers with guns having barrels little better than gas-pipes, and send them into the field armed with an old brown bess to meet a contending army well trained in the use of the Martini-Henry rifles, would not this be bad generalship? Yet this is just what Mr. Curzon is doing at the Horological School. If the best of models, text-books, and teachers are employed to impart a knowledge of the theory of watchmaking, why should the worst of tools be used for the practice of the same? Shall I read to you the humiliating lesson of military importance we learnt in the Crimea, and tell the heart-harrowing details, still fresh in our memories, of much precious life sacrificed by neglect? or shall I flatter your national vanity by relating how, that when the captured attendants of Theodore arrived in this country, immediately after their defeat in Abyssinia, they were taken to Woolwich and shown the enormous resources we possess in instruments of war, which, when they had examined, they exclaimed, "Theodore should have seen these things, and he would not have waged war with such a nation as this;" and if you will compare the miserable appliances with which we are endeavouring to make watches with some of the tools used in America, I think you will be constrained to admit we should have seen these things; and though, doubtless, this vigilance and desire of enlightenment are duties incumbent upon all who take part in a manufacturing enterprise, but more especially to those who have a time-honoured reputation for timekeepers to sustain, though there is reason to fear that by them they are in hazard of being least regarded.

Any man who will walk through Broadway, New York, with his eyes and his ears wide open, can scarcely fail to notice that Americans are not caring to fight Englishmen with eighty-one ton guns, but they are busily engaged in transplanting our great industries in the United States. They well know that it is in these things wherein our great strength lies, and the preventatives we are taking in our business is a poor defence against the men whose ancestors, you may recollect, were met by our forefathers at Bunker's Hill.

In replying to Mr. Poole's letters, I have never felt any want of evidence in favour of the use of machine tools: on the contrary, there is such abundant evidence of their advantage that the difficulty lies in selecting that which is most suitable. At the same time, I hope I have been careful to guard against the lavish expenditure in machinery, which has been fatal, in some instances, in American watchmaking. If time and space would permit, I could furnish the reader with some instructive and amusing proofs for this statement that I have met with in America.

In last month's issue, Mr. Poole quotes from my June paper a sentence in which I intended to guard against the unprofitable use of machine tools, and he immediately stipulates "It is the many variations of style which forms the chief feature of the best English watch trade." I will not detain the reader this month by replying to this crude notion of watch manufacturing; but when I come to consider the first paragraph in his December letter, I will take the two statements together and show how utterly absurd it is to allow "many variations of style," which profit nothing, to stand in the way of substantial advantages. I need not point to the fact that Mr. Poole here departs from the subject under discussion. Originally, it was "*a* dettant cannot be made by machinery," *not* many variations of dettants cannot be made by machinery.

I contend a dettant can be hardened without acquiring even a slight twist or warp; and if it could not, that need not prevent a margin of substance being left in the rough dettant. In my July paper, I have anticipated the enquiry respecting the discharging spring, and have no intention of writing a paper on screw-making; it is so well understood—considering there is a large factory for machine screw-making in Bowling Green Lane, a stone's throw from 33, Spencer Street. I think Mr. Poole ought not to trouble with enquiries of this kind. There is no necessity to fix in the jewel until the dettant is finished. When the machine has been set to a standard, it produces uniform work. The sharp edges may be taken off in a machine. Mr. Bragg has truly said "It is as willing to work for the Spirit of Beauty as for the Demon Ugliness."

RICHARD WHITTAKER.

(To be continued.)

The Construction of a Simple but Mechanically Perfect Watch.*

By M. GROSSMANN, *Watch Manufacturer, Glashuette (Saxony).*

(Continued from page 4.)

114. These are the practical and commercial consequences of the retention and the omission of the fusee in the modern watch, as experience has shown them in these two old manufacturing countries. It is strange to see that the highly creditable invention of Graham—that of the cylinder escapement—has not been a source of much benefit to his countrymen, merely because they rejected the idea of coupling its adoption with a remodelling of the movement rendered admissable by the nature of the new escapement. The Swiss, by adopting this latter course, and by a thorough division of labour, have succeeded in producing a watch of satisfactory time-keeping quality, marketable by its price and elegant form and dimensions, and thus powerfully raised their horological industry.

115. There can be no doubt that the fusee, with its equalizing power, insures a greater uniformity in the rate of a first-class time-keeping instrument, but the degree of superiority obtained by this means has been vastly overrated, and for the wants of common life there is no difference of any practical importance between the performance of a fusee watch and that of a going-barrel one. Even if the difference between the rate in the first and in the last six hours of spring development in a going-barrel watch should amount to ten or twenty seconds, which is far more than ever will result from this cause in a good watch, this would be no impediment to the watch running a general steady rate, because the error would repeat itself regularly in the course of every twenty-four hours, and it would only require to wind the watch in as regular a manner as could be afforded.

116. The employment of the going-barrel allows of a stronger train of wheels and pinions, of a more capacious barrel, and of a less restrained arrangement of the moving parts. It economises power by the omission of the frictional resistance of two large pivots, like those of the fusee, and it has the great advantage of not being exposed to as many accidents as the fusee movement, in which there is the additional danger of a rupture of the chain, besides the breaking of the spring. The going-barrel movement, if properly constructed, so as to have a thin and long mainspring, can be set going with the middle part of a total development of at least six turns; and this main-spring is not so much exposed to breaking as the thick and short spring of a barrel in a fusee movement.

117. But the greatest advantage of all is that the going-barrel movement, with its great abundance of moving power, is much more than the fusee movement appropriate for a quick train, viz., one with 18,000 vibrations in an hour. This quick vibration makes a watch much more fit for good performance, especially when worn by persons riding in carriages or on horseback, or in any other way exposed to continual external shocks. It is quite obvious that the much greater momentum of a balance in such quick vibrations will be much less under the influence of such disturbances than another balance vibrating one-fifth slower. This increased activity of the movement, producing 3,600 more vibrations in an hour, must, of course, be maintained by a greater moving power; and in this point the fusee movement will be found deficient, if it has not an excessive height and diameter, or a very light balance.

118. The consequences of the above considerations may be condensed in the following conclusions:—

The employment of the fusee is recommendable for all watches of which the most accurate time-keeping is expected. The going-barrel ought to be resorted to for all watches not belonging to this class, and especially for the use of such wearers as have to rely on a performance as much as possible free of disturbance—for instance, travellers, soldiers, &c.

119. This point of view was most likely taken by the first watch manufacturers of the United States, when they very judiciously dispensed with the fusee, and which, in my opinion, is a most essential element of their success.

120. Having thus exposed the nature of those cases where the employment of the fusee may be thought useful, it will, perhaps, not be amiss to say a word on the best mode of constructing a sound and well-proportioned fusee movement. In doing so, I cannot help stating that the historical English fusee movement, according to my way of viewing the matter, is not a perfect arrangement, because it is not capable of containing a main-spring of a breadth proportionate to the height of the frame. This, as I intend to show by figures and diagrams, is mainly the result of the placement of the centre wheel in those movements. When I was working in London, I had some conversations about this point with very good horologists, but they were quite positive in dissuading me from attempting any alteration whatever in the construction of the fusee movement. I got up a drawing in which I could not see any mechanical defect, and was quite sure of my plan; but I had not then the facilities for carrying it out in practice. This, however, I did later, and the experiment fully confirmed my former supposition. In hope that it may be useful to some of your readers, I will give a diagram and description of my fusee movement, with comparative figures of its advantages over the English movement. The greatest alteration in this movement is, as will be easily seen, the transposition of the centre wheel from its usual place below the barrel to the opposite part of the frame, above barrel and fusee. The centre wheel can very conveniently be sunk into an upper plate of proper thickness, so as to lie flat with its surface. Then the fusee may come as near the upper plate as in the English movement. The barrel cannot pass through the upper plate, as it does in the usual movements, but it can reach almost down to the dial, save only the thickness of its lower bridge. In the English movement, the centre wheel is an absolute bar to giving any more height to the fusee and barrel, and all the height of frame between centre wheel and dial is lost for these important organs.

(To be continued.)

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Palladium Springs and Adjustment to Temperatures.

"MONS. C. A. PAILLARD," says the *Journal Suisse d'Horologerie,* "has repeatedly informed us that palladium springs behave different, as regards compensation, than steel ones. Practice in adjustment, confirmed by the rate-bulletins issued by the Observatory of Geneva, proved to Mr. Paillard that, in many cases, pocket-chronometers provided with palladium springs did not always show the slight loss at the extreme temperature relative to the mean temperature which steel springs generally display. The rate was sometimes found very closely the same at all temperatures, and in some cases, the rate at 0° and 30° *advanced* slightly on those observed at an intermediary degree. This fact, the importance of which is patent to every chronometer-maker, may lead to the equality of rate which we have hitherto tried to obtain by means of auxiliary compensation, and thus an interesting problem, which has given rise to so many efforts at invention, is found solved in a most simple and rational manner, constituting a marked progress in chronometric art."

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* All rights reserved.

Repairing Swiss Watches.

By Hy. Ganney.

(*Continued from page 5.*)

No. VIII.—Continued.

THE polishers used for the pivots are best when made of square steel, and when filed, if a good shoulder is desired, it must not form an acute angle, or it will rub off or bend, and any attempt to *polish the shoulder* will destroy its squareness, which must result from a few rubs from the edge of the polisher as it moves up and down the pivot as well as across. The small surface of the shoulder will indicate that it cannot require much rubbing, and it generally happens that all shape is rubbed out of the shoulder ere the turning marks have disappeared from the pivot. A well-turned shoulder is necessary to secure a well-polished one, and a slight cut into the pivot at the shoulder, which disappears in polishing, is the only way to prevent a root appearing during the operation. Conical pivots and shoulders are the easiest and best pivots for balances, and after turning suitable shape, may be made entirely with a cutting burnisher made from narrow steel, with the edge bevelled off suitably, which may be learned by experiment, or by filing the steel until it fits a conical pivot and shoulder, against which it is held in the light: a burnisher is preferable to a polisher for this purpose, as it does not vary in shape with use much, and can, when understood, produce definite results when used; and by varying its taper and cone we learn at what part to find the shape that suits the job in hand, some requiring a long taper cone and others a hollow ditto, and success in using these tools depends on knowing what they will do.

We have now indicated the methods in use to produce the exquisite pivoting, which all repairers admire and few can imitate, many believing it to be the result of some extraordinary tools, when it is only the result of skill and application in the use of the most primitive means which elaborate tools will never surpass, though they may give results approaching them in merit at a more rapid rate. The replacing of broken pivots is an operation that good pivoters consider poor economy, as the time spent in drilling a hole to fit the steel is sufficient to make the other pivot; those who are not good pivoters, and some who are, consider a repair should not extend beyond replacing the broken part, which, if truly done, leaves the wheel or balance without alteration in its position. The first requisite is to find the centre of the pinion or arbor, in which the hole for the pivot to be put is to be made; tools with a chamfered hole for the shoulder to work in can be bought at most tool warehouses, and a centre coming through to meet the shoulder makes a recess in the shoulder, to which the drill may be applied; the drill must be hard and its face whetted, as part of a circle, and drilling about as deep as half the length of the pivot will give a hole sufficient to hold securely. If the shoulder is too short or too much undercut, breaking off the shoulder, and drilling large enough for shoulder and pivot, will be best; if too short to work in the tool, the centre must be made with a sharp graver point, and shifted with a dotting centre that cuts well until it is right, or a hole can be drilled in a piece of wire and put over the shoulder, and a centre made and worked through it. When the hole is drilled it will be done truly by revolving the wheel and pinion with ferrule and bow, and holding the drill against it; and the application of turpentine to the drill will facilitate its action. A piece of suitable steel, well tempered, is fitted to the hole and pushed in half-way, then a smart blow with the hammer is given to drive it home, and the required lengths nipped off; the shoulder is then placed in the hollow centre of the turns and the pivot projecting through it turned true and right size from it as a bearing; if the shoulder is not available for this purpose, the pivot must be centred in the usual way, and the truth of the pinion tested by revolving it in the turns and holding a piece of chalk near the pinion, so that it marks those leaves that are not true; it must be got true by filing the centre of the pivot in the required direction, and then the pivot must be turned true and finished in the usual way. In replacing cylinder pivots we avoid the trouble of drilling, as the pivots are made from plugs inserted in the cylinder, which may be removed by applying a suitable punch to the interior of the cylinder, which rests on a chamfered hole whilst the punch is applied. Several punches are required, as the punch that starts the plug cannot be so weak or so long as that which expels it, and the steel that forms the punch is filed away to allow it to free the adjacent parts; only a small amount of substance is available for the interior of the cylinder. The punch is in shape like a leg and foot, with a heel at the toe, which does the work of expelling the plug. With the exception of being turned from a much larger piece of steel, and carefully fitting and squaring the ends, the work is the same as other pivoting. Before putting in the cylinder, the plugs and pivots may be nearly turned right size and undercut, and the plugs being undercut, with a small projecting arbor left to be broken off, last thing. Before driving in the plugs, all the rough turning is done without the cylinder, whose inner surface must rest on the face of a thin pair of steel rivetting clams, whilst the plugs are driven down with a hollow punch, pressure or a light hammer being sufficient, as they must be well fitted by smoothing after turning with a polisher and oil-stone dust ere they are pushed home, or the cylinder will be destroyed. For greater safety the cylinder may be filled with shellac and a small brass ferule and shellac used to turn and finish the pivots. When in their position, heat must be applied to attach and detach the ferrule, and what shellac is in the cylinder must be removed by picking out with a fine drill, or dissolving in alcohol. Conical pivots will be the easiest and most proper to make, though seldom found in Swiss watches originally.

(*To be Continued*).

Chamber Masters.

The watch trade of Clerkenwell, and by it that of England, has been long gone, so far as the manufacture for the million is concerned. Does it not seem lamentable that the English artisan is compelled to have his watch from the valleys of France and Switzerland, instead of from his own country? We, who can invent and teach mechanics to all the world, are unable to make watches as cheaply for our working-people as the foreigner. It sounds like a reproach; and what can be the reason? Well, the principal reason lies in the system of what is known in the trade as "chamber masters;" that is, small men who follow some particular branch, the jobs of which they distribute among poor starvelings vegetating in some wretched garret. There is no unity; nothing but the pressure of hunger makes them work; as a rule, no system; and they will do the job at home almost how and when they like. What is the remedy for all this? The application in practice of three great principles—namely, capital, machinery, and discipline: capital, ample and well directed, the utmost development of machinery, and the rigorous discipline of the workshop. In the case of the watch trade, the disease may be set down as beyond the hope of cure. The ingrained self-will of both "masters" and men of the chamber kind would, even if the capital was ready, be found to be immovable and insurmountable; a dead, galling weight too disheartening to encounter, or to risk anything worth while upon. Hence the valleys of Switzerland thrive upon the Pactolean stream that should be irrigating the barren dales and uplands of Clerkenwell.—*Tinsley's Magazine*, 1869.

The Silver Duty.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—The government proposal for settling the question of the silver duty unsettled everything and resettled nothing. To affect a belief, as some do, that it will not be re-opened, is to take a very superficial view of the conditions under which a branch of manufacture can be carried on to the advantage either of producers or consumers. An agitation where there is no real grievance to redress, must die down from want of fuel to keep it alive; but when you are dealing with a subject which was looked upon by one government as important enough to justify the granting a select committee to hear evidence and report to Parliament, and another different government to attempt legislating with a view to its complete and final settlement, it needs but little reflection to see that this is a question which cannot be solved by the results of an untoward accident. The proposed solution was brought forward by a minister who was unable from the pressure of more important affairs to give up enough time for devising a plan which should be either just or effective, and he as a consequence failed to satisfy any one.

The silver trade suffers from a complication of disorders, any one of which would be difficult enough to successfully bear up against, but when combined, they depress and destroy it beyond hope of recovery. The rivalry of electro-plate cannot be put aside; it is a legitimate manufacture which is carried to a high degree of excellence, and favoured by the neglect of the Goldsmiths' Company to compel the adoption of a system of marking which should at once distinguish it from sterling silver, it has by that neglect been given an advantage in the market which does not rightly belong to it. When the manufacture was first coming into demand, it was common for Sheffield merchants to receive orders for electro goods, "silver marked," that was to say, marked as near like silver goods as they dared to go, and how near they have gone in position and general appearance is a matter of sufficient notoriety. Probably it is too late now to redress that grievance, but it remains a standing evidence, how dangerous it is to hand over the government of a trade to a body who have no direct pocket interest in its prosperity.

Other trades are subject to like rivalries, yet they flourish. We do not hear that the demand for gilt jewellery with imitation gems, is crushing out the trade in genuine jewellery; the wonderful lace frame work of Nottingham does not make less covetable, in the eyes of those who can afford to buy, the beautiful handiwork of Brussels or Honiton; even the nickel electro-plate trade itself has of late years had a formidable rival in the shape of plated Britannia metal ware, yet in times of general prosperity it prospers and increases.

In order to strengthen their case, certain advocates of the policy that would leave the trade in its present hopeless condition, affect to speak of electro-plate as being in appearance a perfect substitute for silver. Let those who affect this way of thinking take a look at the evidence of Mr. Attenborough as reported in the Parliamentary Blue Book for 1879 on the Hall marking and Silver duty questions, which may be found from page 39 to 53. Without doubt his evidence was biased by his particular line of business, and therefore allowance must be made for the extreme view he takes, but the scornful comments he makes show that he does not go in opinion with those who, for a purpose, seek to exalt the merits of the inferior substitute to a level with the genuine article, and he only echoes the opinion of nine-tenths at least of those who think at all on the subject.

Silver plate would no doubt cope as successfully with its inferior rival as the other branches of trade we have named, were it relieved from the impost of a duty equal to one third the value of the raw material of manufacture. Some time ago we had a very confident expression of opinion on this point, from one whose name and position give him a sort of prescriptive right to be looked upon as a leading man in the silver trade. Making every allowance for the often observed effects of a good dinner with the usual accompaniments, it certainly needs no small degree of confidence to stand up before an audience consisting mostly of men of business, and enunciate the opinion, that the abolition of the duty of eighteenpence per ounce on manufactured silver plate would not lead to the manufacturing and sale of a single additional ounce in the course of twelve months. Will the eminent manufacturer who makes known this remarkable theory, do us the further favour of defining the limit, if there be a limit, at which a duty does become a hindrance to the prosperity of a manufacture? In this case, would eighteen twopences or even eighteen shillings do it? And if not, why should the Chancellor of the Exchequer hesitate to dip deeply into this Fortunatus's purse, and increase instead of abolishing the duty? It could do the trade no harm, and the country a great deal of good. Every schoolboy should know by this time that the effect of imposing a duty on the raw material of manufacture is to add to the cost of production, to advance the price of the product, and therefore to limit the demand for it. The Parliamentary Committee, which comprised men so eminent in finance as Mr. Goschen and Mr. Hankey, after hearing all that could be said by men of like opinion with our eminent silversmith in favour of retaining the duty, scarcely deigned to allude to it in their report; it was to them a self-evident truth that all excise duties act as fetters to the trades on which they are imposed, and they advised that this one should be abolished as soon as the exchequer could do without it. The bulk of the public are now for the first time aware that there is a silver question to be settled; it may be safely affirmed that there are ten persons aware of the fact now for every one who had an inkling of it before Mr. Gladstone made his abortive attempt to deal with it, and it is easy enough to surmise what effect this newly acquired knowledge will have on the minds of intending purchasers.

It is not difficult to follow out the kind of reasoning that prompts certain individuals to talk as they do. Having a large share of the trade that is being done, they may be supposed to think in this way: "I have a good business, and I want to keep it. If things go on as they are I shall certainly keep it, but if they change, I may not be able to keep it." New men who desire to make their way in the world know that changes may bring them opportunities, and they are on the look out for them. Businesses, especially close ones, have a tendency to run in a rut, and newer and more available ways are more likely to be opened out by new men than by men of routine. We may therefore expect a continuance of the opposition to any change, except in the direction of greater restriction, from those who at present enjoy what fruits may yet be gathered from the business; any appeal to them is therefore useless. It is the shopkeeper whose sales are thereby restricted, the small manufacturer who is getting no return for his capital, and the workman who feel the evil in full force, and for them there is no hope of better times till the impost is for ever swept away. The system which is so keenly defended by the few whose purpose it serves, has had a long and fair trial; it has failed not only to advance, but even to stand still, it goes back and back, and if not speedily arrested will involve in ruin the bulk of those whose only dependence is on its prosperity.

One ground of hope remains yet for the working silversmith. Voluntary emigration has failed to supply men fast enough for the rapidly growing silver trade in the United States. It is a strange contrast, that while we are here complaining that electro plate is stifling the sale of silver plate, the Gorham company, the largest in America, should have entirely abandoned the manufacture of the former, and now confine themselves to the making of solid silver wares, the demand for which is now so great that a partner has been over to this country seeking to engage workmen of the best kind. Some tell us as an explanation that the Americans are fond of show, but it is evident that they are also fonder of substance than we are in this particular at least. May not their taste prove to be a catching one? We are told there never were so many well-to-do Americans in England as now, and that we are growing nearer to each other in habits and tastes: they are bidding at sales for our choicest pictures, and we are buying by thousands their beautifully illustrated magazines: why should we not also be infected by their taste for beautiful silver plate? at least, there is no good reason why we should not indulge in hopeful, as much as others do in desponding theories.

The Gorham partner who visited here was possessed of a wise discrimination; he desired to find workmen who could not only use their tools, but who could also design their own patterns. This is a class of men who are necessarily very scarce, and will always be so; to supply them there must be the combination of natural aptitude with much study. The ever changing fashions, now-a-days, in plate as in other manufactures, call for a versatility to which the men of former generations were unaccustomed. An accomplished workman, especially in the strictly ornamental branches, must be the joint product of the school of art, the technical institute, and the workshop, and when he has been completed, should take up a good position in a manufacturing community. But a falling trade like that of the silversmith can make no new opening for such men when they are perfected. Shall it be then that the Goldsmiths' Company, by liberally aiding our projected Technical Institute, after having done so much for the electro-plater at home, will now confer the greatest possible benefit on the American silversmith, and by a continuous flow of the most competent class of workmen, be of incalculable service to our enterprising and long sighted cousins? This would be the crowning achievement of our ancient guild, and benefactions, the earliest of which were left for the good of our craftsmen long before Columbus first set out on his adventurous voyage, will go to the advantage of those who know how to make a profitable use of them in our day.

There seems to be in London an urgent want of some working silversmith, with an eye keen enough to see, and a tongue bold enough to speak out against, the fallacious fancies put forward by the men who believe their interests to be in the continuance of the trade in its present forlorn condition; it has stuck fast, and unless they put their shoulders to the wheel, the prospect for themselves and for their sons is by no means a cheering one. That, at least, is the well-considered opinion of

AN OLD HAND.

Chemistry of the Platinum Metals.—Theodor Wilm finds that, contrary to the prevalent view, all the platinum metals, if precipitated by zinc in a state of very fine division, are soluble to a considerable extent in nitric acid, whether weak or strong, so that palladium cannot be separated from such a mixture by means of nitric acid. The solubility appears to depend on the relative proportion of one or other of the metals in the mixture (mass action). Pure palladium, even in thin leaves, is not easily soluble in nitric acids, whilst all the other platinum metals are perfectly insoluble if in a moderately compact condition. Palladium cannot be isolated by agitation with mercury from a solution which along with the platinum metals contains base metals, such as copper, lead, &c., since the mercury precipitates not merely the palladium, but all the other platinum metals, forming probably amalgams. From the platinum metals thus precipitated by mercury metal free from mercury cannot be obtained by distillation and subsequent ignition, since a part of the mercury forms a stable compound with the platinoids.

Practical Instructions to Jewellers, Silversmiths, and Electroplaters.

By A. Roseleur.

(Specially Translated and Revised for this Journal.)

Continued from page 7.

No. XXVII.

1. With Silver.—An electro-silvering bath is prepared by dissolving in two and one-fifth gallons of water five and a quarter ounces of fused nitrate of silver, and adding nine ounces of pure cyanide of potassium; this at first produces an abundant precipitate, which soon dissolves. The filtered liquid is the silver bath, in which is steeped the zinc article previously coated with copper or brass. Under the influence of a proper electric current, the silver deposited is of a handsome frosted, dead lustre appearance, and perfectly white. The object is then rapidly and thoroughly rinsed, and dipped into an electro-gilding bath, of which we shall give the composition. The dead gilding by this process is very fine and silky, but is soon darkened by the sulphuretted hydrogen of the atmosphere and of gaslight, which sulphurizes the silver through the thin film of gold.

2. The galvano-plastic process is both more durable and more economical than that with silver. Add to the necessary quantity of water one-tenth of its volume of sulphuric acid: in this dissolve as much sulphate of copper as it will hold at the ordinary temperature. This solution will mark from 20° to 24° Baume; then add enough water to reduce its specific gravity to 16° or 18°. This galvano-plastic bath is generally held in large vessels of stone-ware, slate, wood, or gutta-percha, and porous shells are immersed in it, filled with a weak solution of sulphuric acid and of amalgamating salts. Plates or cylinders of zinc are put into these cells, and are connected by binding screws with one or more brass rods which rest upon the sides of the trough, and support the articles which are to receive a dead lustre in this bath. The articles of zinc previously coated with copper or brass suspended to the rods remain in the solution of sulphate of copper until they have acquired a satisfactory dead lustre. A few seconds after the articles have been placed in the bath, withdraw and examine them carefully; should the previous coat of copper or brass be insufficient to resist the corroding action of the acid solution of sulphate of copper, there is produced a muddy dark deposit, which is easily removed with the finger. Should this occur, the object must be scratch-brushed, and placed again in the former alkaline baths of copper or brass, in order to increase the deposit which protects the zinc in the galvano-plastic bath. When the galvano-plastic dead lustre is successful, the deposit is perfectly regular, and of a pink shade, which possesses great freshness. When it is irregular, marbled, crystalline, of a vinous or fire-red colour, and dull or earthy in appearance, these defects are due to the following causes: either the bath is in a bad state of conductibility or of saturation, or the surface of the zincs is too large in proportion to that of the objects, and, therefore, too much electricity is given out; or the previous electro-deposits of copper or brass were insufficient or inferior in quality. The remedy for either of these inconveniences is easily found out, and only requires a little care and attention. The galvano-plastic dead lustre being satisfactory, two preliminary operations are needed to ensure the success of the gilding. They consist in rapidly passing the object, after rinsing, through a solution made of water, two and one-fifth gallons; nitrate of binoxide of mercury, one-third of an ounce: sulphuric acid, two-thirds of an ounce; then, after rinsing, place it in another solution composed of water, two and one-fifth gallons; cyanide of potassium, fourteen ounces: nitrate of silver,

three and a-half ounces. The object acquires a slightly white tinge in this liquor, and is again rinsed in fresh water before being put into the following gilding bath:—Distilled water, two and one-fifth gallons; phosphate of soda, twenty-one ounces; bisulphate of soda, three and a-half ounces; cyanide of potassium (pure), one-third of an ounce; chloride of gold (neutral), two-thirds of an ounce. The mode of preparation of this bath is given in the receipt for hot gilding bath. This bath should be nearly boiling, and worked with an intense galvanic current. The anode is a platinum wire, which, more or less immersed in the liquor, allows of the regulation of the amount of electricity according to the volume, weight, and surface of the object to be gilt. This gilding requires an energetic electric action at the beginning; this is obtained by steeping the platinum wire deeply in the liquid—to have the entire surface of the piece covered instantaneously. As the thickness of the deposit increases, the anode is gradually removed from the bath until it only dips in a little. The gilding by this method has a remarkable freshness of tone. Before using the bath with battery, the zinc articles may be passed through a preparing bath—this is the same as a gold bath for dipping—or the gilding may be done in two operations. After having deposited about half of the gold intended for the object, remove it from the bath; wash, pass again through the mercurial solution, and replace in the gold bath for finishing the gilding. After gilding, the articles are rinsed in clear boiling water for a few seconds to remove any saline matters; they are then dried in the stove, or in warm sawdust of firewood. All friction should be carefully avoided, so as not to scratch the dead lustre. When parts of this gilding are burnished, their colour is green if the frosted surface has been obtained in the silver bath, and red if the galvano-plastic bath has been employed. These inconveniences are remedied by dipping the burnished article for a short time into the gold bath. This last deposit of gold must be so thin as not sensibly to impair the brightness of the burnished parts. Dead lustre electro-gilding upon zinc will only suit such objects as have no friction to bear, and which are not often handled. It is especially useful for clocks and similar articles which remain under glass. The dead lustre gilding here described can be applied to all metals and alloys, provided that those corroded by the solution of sulphate of copper be previously coated with copper or brass. These previous coatings are always desirable, as they prevent crystalline and irregular deposits, often formed upon metals which are not corroded by the bath of sulphate of copper. The galvano-plastic dead lustre upon copper is much finer when the pieces have been covered with copper or brass in the alkaline baths. Faded gildings may be renovated by dipping them into a weak tepid solution of cyanide of potassium, and afterwards into very dilute nitric or sulphuric acid. Imperfect gildings may be removed by inverting the poles in a solution of cyanides, connecting the gilt articles with the positive pole, carbon or copper, and the negative pole, zinc, with the anode, which becomes gilt. This process is employed for removing the gold from articles of iron, steel, and silver, which cannot be submitted to the ungilding bath. Silver, copper, and brass may also be removed by similar processes.

To be continued.

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Opaque Green Enamel.—Eight parts crystal glass; 1 part tin oxide; 2 parts borax; 1 part calcined sheeps' bones; 1 part verdigris; 1 part blue carbonate of copper. Glass and borax first; subsequently add the remainder one after the other. If it shouldbe too dark, add ½ chromium oxide at the second melting. This gives it a very pretty leaf-green colour.

The Sancy Diamond.

The art of diamond-cutting is usually supposed to have been invented by Louis van Berquem, of Bruges, in 1456; but closer inquiry shows that he only introduced important improvements into a method already in use. It is said that there were diamond-polishers at Nuremberg in 1873, and the same trade was exercised early in the following century in Paris, where a cross-way called "La Courarie," once inhabited by the workmen, still exists among the diminishing relics of the past. Nor is it to be supposed that this art was entirely unknown to more ancient nations. In India, from the earliest times, a mode of releasing the crystal from its native husk was employed, which probably differed less in principle than in application from that now used in London and Amsterdam. The gem-engravers of antiquity not only worked extensively with the diamond-point, but in some cases engraved the "indomitable" stone itself. In the Duke of Bedford's collection, for instance, is a diamond engraved with the head of Posidonius, and one bearing a portrait of a Roman emperor was to be seen at the Paris Exhibition, 1878. It is unquestionable that Berquem first introduced the method of cutting diamonds into regular facets, and employed for the purpose the wheel, with the powder of the gem itself, precisely after the modern fashion. In 1475, he made his first experiment of the "perfect cut" on three rough stones sent him by Charles the Bold, who was famed for his magnificence in jewels. All three were worn by the unfortunate Duke of Burgundy, probably with some regard to safety as well as to splendour, in his disastrous battles with the Swiss, but the talismanic value had gone out of them, for they were lost with the fortunes of their owner, and after many singular adventures, found their way each to the treasury of a separate foreign potentate. The most celebrated of these was the "Sancy" diamond, a fine stone of 53½ carats. It was picked up on the field of Nancy by a Swiss soldier, who sold it for a florin to a priest; unsuspiciously redisposed of by him for a scarcely larger sum, and transported by the currents of chance or trade to Portugal, where it figured in 1489, among the crown-jewels of the unlucky Don Antonio. This monarch in difficulties first pledged, and then sold it for 100,000 livres to Harlay de Sancy, a French nobleman, whose descendant, Nicolas de Sancy, was induced to place the gem in pawn for the relief of a pressing exigency of the crown in the time of Henri III. For this purpose it was entrusted to a servant to be carried to a jeweller at Metz; but neither servant or jewel reached their destination, and the conclusion seemed inevitable that the temptation had proved too strong for the man's fidelity. De Sancy alone never wavered in his reliance on the devotion of his dependent, and maintained that only with his life would he have separated with the precious charge committed to him. And in fact, after some further search had been made, the murdered body of the messenger was found by the roadside. It was opened, and the diamond was discovered in the stomach! Thus, by a last and despairing expedient of fidelity, this nameless hero baffled his foes at the very instant of succumbing to them, and left to posterity the memory of an action brighter than the gem whose safety it secured. Through some unknown channel the "Sancy" diamond came into the possession of James II. of England, shared his exile, and was disposed of by him "for a consideration" to his royal host. The "well-beloved" Louis wore it in the *agrafe* of his hat at his coronation, and it rested quietly in the treasury at the Tuileries until the troubles of the Revolution once more set it in circulation. It found its way to Spain, was sold by Godoy to Prince Demidoff, and purchased from him by Sir Jamsetjee Jejeebhoy for the sum of 200,000 florins. And here for the present its story ends.—*Frasers' Magazine.*

Trade Notes.

His Royal Highness the Prince of Wales, who was accompanied by the Princess, on Monday, the 18th ult., laid the foundation stone of the Central Technical College for the City and Guilds of London Institute at Kensington. He has graciously consented to accept the presidency of the Institute, which is likely to exercise great influence over the future technical education of our artisans. The building will be of five storeys, including the basement, and will contain two theatres, large laboratories, about forty class and lecture rooms, private rooms, a council chamber, reading and refreshment rooms, and ample accommodation for offices and management. The estimated cost of the building, including fittings and professional charges, cannot be much under £71.000; and to this sum must be added at least £5,000 for apparatus and furniture, making £76,000. The amount already promised from the Fishmongers', Goldsmiths', Clothworkers', and Cordwainers' Companies towards the building fund is £30,500, and it is estimated that by putting away £5,000 a-year till the opening of the building, the total sum of money at the disposal of the Council for the purposes of the Central Institution, including the amount already funded, will be not more than £55,500. There is consequently a deficiency of about £20,000, for which amount the Council look to the liberality of the Livery Companies, in order that the Institution may be completed without delay.

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It is scarcely within the province of a trade journal to refer to military topics, but the Volunteer Review held by Her Majesty in Windsor Great Park on Saturday, July 9th, was of so exceptional a nature, that it is worthy of notice in all English publications. Nearly 60,000 representatives of the "nation of shopkeepers" passed in martial array before their Sovereign, it being the largest assemblage of troops ever brought together in this country.

* * *

The Watchmakers, Jewellers, and Silversmiths have not been behindhand in taking part in the volunteer movement. Among the names of those gentlemen who either hold or have held commissions, we find those of W. Hislop (deceased), a former Secretary of the Horological Institute; T. W. Vine, R. Rolfe, J. U. Poole, E. H. Johnson, and G. A. Potter, the foregoing all being connected with the 21st, late 39th Middlesex R. V., originally known as the Clerkenwell corps. The names of Lambert, and E. J. Watherston have the prefix of "Captain" attached, in connection with the Queen's Westminster Volunteers, the former gentleman still retaining his position; while J. M. Garrard, Esq., has only recently resigned the command of the Light Cavalry troop of the Hon. Artillery Company.

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As an appropriate conclusion, we may mention that on the 23rd ult. the Lord Mayor entertained the Volunteer Commanding Officers at a dinner at the Mansion House, and the guard of honour supplied by the London Rifle Brigade was commanded by Captain Matthey, of the well-known firm of Johnson, Matthey, & Co., Hatton Garden.

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We believe that no worker in the precious metals has yet had the honour of winning the Queen's Prize at Wimbledon, but this distinction may yet be awarded to some rising workman; in the meantime, we are glad to be able to note that those connected with the trades which especially come under the notice of this Journal are not unmindful of the claims of their country.

The Decorative Art Exhibition, which has recently opened at the new galleries, 103, New Bond Street, under the direction of Mr. J. Gullick, is very interesting and instructive. It gives equal place to "fine" and "applied" art, blending the two ideas, which, with the old masters, were one. Among the exhibits of special interest to our trades, we may mention the Roman and Florentine carvings in coral and shell, by Francati and Santamaria; Italian art jewellery of archæological character, by Melillo; similar specimens of skilled and artistic goldsmiths' work, by C. Guiliano; relics of a past age, in which Benvenuto Cellini left examples of such craftsmanship as, till lately, have been thought unapproachable, but are so no longer; Japanese cloisounées, bronzes, &c.

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Mr. Gorham Thurber, of the Gorham Silver Plate Manufacturing Company, Providence, Rhode Island (the largest silversmiths in the world), was one of the guests at the Pyx dinner at Goldsmiths' Hall.

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Mr. J. U. Poole, in moving a vote of thanks, on Wednesday, at the half-yearly meeting of the Horological Institute, to the President (Sir Edmund Beckett), observed he thought English watch manufacturers were placed at a disadvantage from the very meagre display which they were able to make of the various processes of manufacture. He stated that a relative of Sir Salar Jung had recently visited Clerkenwell, to obtain general information on the topic; and had such a collection been available for inspection at the Horological Institute, the prince would certainly have been much interested.

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At the Maldon Borough Quarter Sessions, held July 5th, 1881, James Claxon and George Claxon, hay binders, and John Taylor, hurdle maker, were found guilty of receiving a quantity of watches and jewellery, knowing them to be stolen from the shop of Mr. Chas. Eve, jeweller, Maldon, and were each sentenced to twelve months' imprisonment, with hard labour. The robbery occurred as far back as November, 1880.

* * *

Recently, at Birmingham, a daring burglary was committed on the premises of Mr. Holloway, pawnbroker and jeweller, corner of Fazeley-street and Heath Mill-lane. The thief, or thieves, cut a hole in one of the shutters, and having broken a pane of glass, succeeded in abstracting from the window a number of diamond, wedding, and fancy rings, and several silver watches, valued together at about £100. It is supposed that an attempt was made to obtain access to the premises about one o'clock the same morning, but a dog who is kept in the shop aroused the inmates by his barking, and thus temporarily thwarted the thieves.

* * *

From the Pass List of the City and Guilds of London Technological Examinations, May, 1881.—Watch and Clock-making.—*St. Thomas Charterhouse, London* (I. Herrmann's Class).—William Craighead, 1st Class Elementary; Francis Augustus Deede, 2nd Class Elementary; James Gosling, 2nd Class Elementary; Ignatz Herrmann, Junr., 1st Class Elementary; Edward Hesk, 1st Class Elementary; Peter Hill, 1st Class Elementary. Thomas Daniel Wright, 1st Class Elementary—2nd Prize, £2, Bronze Medal. H. Cowper, Technical Class. John Agget, 2nd Class Elementary (Student of the Charterhouse Class). *Liskeard.*—William H. Huddy, 1st Class Elementary—1st Prize £2, Silver Medal. *Plymouth.*—Thomas Edmund Marsh, 2nd Class Elementary.

Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann, on Monday Evenings, from October 25th.*

(Continued from p. 11).

SIZES OF PINIONS IN RELATION TO CONTACT.

In tracing the conditions of the addendums that effect the lead and determine the angular position of the "closing point" of a tooth and pinion leaf, we have assumed the radii to be in ratio of the teeth and leaves, and the line of centres to be equal to their sum. Maintaining the last proportions, we will now consider the effect of a departure from the former.

If we draw a line, joining the points where two adjacent pinion leaves meet the pitch circle, that line is the chord of the arc contained between them. It is the magnitude of this chord that determines the angular position of the contact before or past the line of centres, assuming the form of the teeth to be in harmony with the conditions to be satisfied, and as the chord varies as the radius, we may use the term "size" as an equivalent, expressing a synonymous measure.

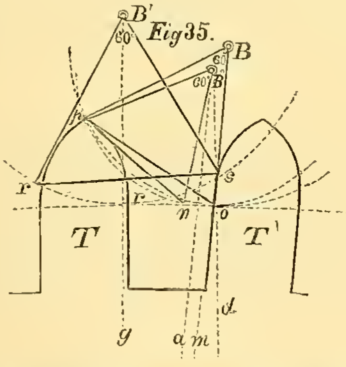
Fig 35.

Let T and T¹ (Fig. 35) represent two adjacent teeth of a wheel, geared into a pinion of six leaves, whose centre is B, and two of its pinion faces represented by p B and o B respectively, and let p B o be the angle contained between the faces of two adjacent leaves and $p\,o$ its chord, since $p\,B\,o = \frac{360^\circ}{6} = 60^\circ$, $p\,o = p\,B = o\,B$.

It is evident from this that in a depth with a pinion of 6, with the radius of its pitch circle equal to a line drawn from the point of a tooth to the origin of the addendum of the next, contact is made practically in the line of centres. A departure from this radial magnitude will give contact before or past the line of centres, as pB becomes greater or smaller.

Let B^1 (Fig. 35) be the centre of a pinion whose chord $r\,s$, or radius $r\,B^1$, is one-sixth of pB greater, then r and s will approximately be the points of contact, and $r\,B^1\,g$ is the angle of contact past the line of centres, and $g\,B^1\,s$ the angle of contact before the line of centres. This admits of mathematical proof, and would form instructive exercise, but does not come within the scope of the present lectures.

It is easy to see, however, that the positions given by r and s practically represent the fact. Double contact can only take place when the chord of the arc contained between the adjacent pinion leaves is equal to any line drawn from any point in the addendum to any other in the addendum of the corresponding tooth that lay in the arc of the chord, or in the pitch circle of the wheel. Thus, if any point is taken between s and o on tooth T¹, then a line drawn from this point to a point in the curve $r\,p$, tooth T, through which the arc $r\,r^1\,s$ passes, will be less than the chord $r\,s$, and therefore $g\,B^1\,s$ must approximately represent the angle of contact before the line of centres.

Again, let B'' be the centre of motion of a pinion, whose radius is less by one-sixth of B o, and let $p\,n$ be its chord. Then, since this chord is less than $p\,o$, the contact is made past the line of centres = to $\angle\, n\,B''\,a$, with an angle of drop proportionate to $n\,B''\,d$. We learn from this that, with pinions of different sizes, and lines of centres which are the sum of the radii of the pitch circles of the wheel and pinion, the angular position of the point of contact is determined by the radius or size of the pinion; and hence, also, that it would not be practical to pitch a large-sized pinion according to the former rule, viz., so that the pitch circles of wheel and pinion coincide in the line of centres. We can show, however, that there is a line of centres, which is a constant quantity, however the pinions may vary, within a certain limit, and which will give approximately a constant angular position within these limits of pinion variations. Likewise, in wheels whose addendums fall short of a proper height, the origin of its curve cannot be the point where contact is made. It is evident from these facts, that we have new conditions entering into our calculations, and these conditions we will call

Virtual Pitch Circles.*

In daily practice we have to construct and adjust depths with given wheels whose addendums are of every conceivable form, and pinions whose sizes are not in harmony with the rule of proportion, yet contact at or near the line of centres is a mechanical necessity that admits of no modification.

If, then, in a depth with a pinion of 6, the addendum is less than the conditions to be satisfied require it to be, it is evident that to ensure the desired position of the contact, the "apparent pitch circle" of the wheel cannot be the "effective" or "virtual" one—that is, it must lay within that point of the tooth where the curve of the addendum commences, and that approximately to the extent of a breadth of tooth, as has been shown, assuming the breadth to be equal to the space. Likewise, if the pinion is in excess of its right proportion, its virtual pitch circle must lay within its apparent one—that is, its radius must be such that a chord of an arc contained between two adjacent pinion leaves corresponds with a line drawn from the end of a tooth to a point in the adjacent tooth, through which the virtual pitch circle passes—in other words, the line of centres is always equal to the sum of the primative radii of wheel and pinion, which are in ratio of the number of teeth in the wheel and leaves in the pinion.

Let P (Fig. 36) represent a pinion of 6 geared into a wheel, of which T, T¹, T², and T³ form a section. Let $a\,a^1$ represent the apparent pitch circle of the wheel, and $b\,b^1$ the periphery of the wheel; also let $o\,r\,o^1$ of tooth T . . . . T³ respectively represent an addendum which is erroneous, and of which o is the origin. From what has been shown, it appears evident that if the pinion is geared into this wheel so that its pitch circle coincides with $a\,a^1$, the addendum $o\,r\,o^1$ is not high enough to carry the pinion leaf to the required angle, and the result must be a large angle of contact before the line of centres. $o\,s\,o^1$ of tooth T shows the defined addendum, of which $m\,s$ is the height. But since $m\,s$ is the distance of the point of a tooth from its pitch circle, therefore this distance, measured off from r equal $r\,n$, must determine the virtual pitch circle, which is, therefore, indicated by $n\,n^1$.

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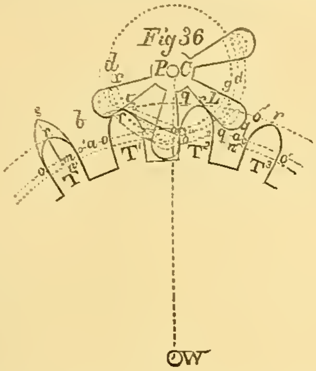
* All rights reserved.

* We have advisedly used the term, "Virtual," instead of "Effective," because it is more agreeable to the ideas represented in mechanics by the terms "Virtual Lever Arm." "Virtual Moment," "Virtual Velocity."



Let P be a pinion, whose pitch circle is in excess of the proper proportion. Take any radius, such that a chord drawn between two leaves to that radius corresponds with a line drawn from r, tooth T^1, to o, tooth T^2, then $o\,d\,d^1$ will be the virtual pitch circle of the pinion, and radius W o : radius o C : : number of teeth in the wheel : the number of leaves in the pinion. Within a certain limit we can evidently use a large-sized pinion, but this limit is determined by the position of the rounding $q\,q$ of pinion leaf L, in relation to addendum $o\,r$ of tooth T^1. If q in its passage over the virtual pitch circle $n\,n^1$ makes contact with $o\,r$, then we obtain the condition shown in Fig. 29, and the depth must stop immediately.

There is evidently no practical advantage in a large-sized pinion whatever, either for clocks or watches. Some exception is claimed for recoil escapements, of which we will take notice when we treat of them.

The same principle holds good in small-sized pinions.

Let $x\,y$ represent the pitch circle of a small-sized pinion, then r would be the point where contact ceases, and a where it commences, because $r\,a$ is equal to $t\,z$.

We have, therefore, shown that, to a given wheel, the line of centres must be a constant quantity, though the radius or size of pinion may vary. Thus, in Fig. 36, C is the position of the centre of motion of three different-sized pinions, and W C, the line of centres, is a constant quantity.

Remarks.—A wheel with a short addendum has this advantage, that if a depth is pitched shallow, contact is not made on a point in the curve which lays outside the origin, whereas, in a higher addendum this would follow, and, therefore, we should have more resistance in the latter than the former.

To Find the Pitch Circle of a given Wheel.

The radius of the pitch circle of a given wheel can be found by three different methods:—

1st Method—

Let the radius of the pitch circle of a wheel of 60 teeth = 10, then the breadth of a tooth

$$= \frac{3{\cdot}1416 \quad 10}{60}$$
$$= {\cdot}5236$$

adding this quantity, the radius of the periphery of the wheel = 10 + ·5236 = 10·5236.

Let the radius of the periphery of the wheel whose pitch circle radius is to be found = 5, then making the former quantity's first and second term of a proportion, and representing the radius of the pitch circle by x, we have

$$10{\cdot}5236 : 10 : : 5 : x$$
$$x = \frac{10 \times 5}{10{\cdot}5236}$$
$$= 4{\cdot}75$$

2nd Method—

The breadth of a tooth at the periphery is

$$= \frac{3{\cdot}1416 \times 5}{60}$$
$$= {\cdot}2618$$

Deducting this quantity from the radius of the periphery, and making the remainder the radius for a new division, then the radius of the pitch circle

$$= 5 - \frac{(5 - {\cdot}2616) \times 3{\cdot}1416}{60}$$
$$= 5 - \frac{4{\cdot}738 \times 3{\cdot}1416}{60}$$
$$= 4{\cdot}75$$

3rd Method (*M. Grossman's formula*)*—

$$5 - \frac{\text{radius of periphery} \times 3}{\text{number of teeth}}$$
$$= 5 - \frac{5 \times 3}{60}$$
$$= 5 - {\cdot}25 = 4{\cdot}75$$

Pinions, their Spaces and Roundings.

It is a matter of general agreement among watch and clock makers to allow two-thirds of the angle contained between two adjacent leaves for space, and one-third for the leaf. This, no doubt, is the minimum for spaces, in order to have the necessary clearance for teeth, so that $r\,o^1$, tooth T (Fig. 36) is perfectly free of the back $q\,q$ of pinion leaf L.

If we can ensure contact at the line of centres, no projection beyond the pitch circle of the pinion would be necessary. It follows from this that it is needless to discuss the form of the pinion addendum, because only a very small section of it can enter into action at the most, and practically an equal section of a curve is identical with that of an arc. Hence, circular roundings satisfy all conditions. This arc may be described with a radius equal to half the thickness of a leaf, and centre in the chord of the leaf.

Short Practical Method of Checking the Sizes of Pinions.

To the number of the pinion add 2 and divide by 3, and the quotient is the measure of the diameter of the pinion.

Example.—Pinion of 7:—

$$\frac{7 + 2}{3} = 3$$

Thus, if with a pinion gauge we measure from o, tooth T, to o^1, tooth T^3, this will represent the diameter of the pinion.

This method is given by Saunier, and although ridiculed by M. Grossman, it can be shown that it can be practically trusted.†

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* Notiz Kalender für Uhrmacher. p. 7, by M. Grossman.

† The chord of three teeth of a wheel of 60 whose radius is unity, measured at the pitch circle,

$$= 2 \text{ Sines } \frac{360^\circ}{240} \times 5$$
$$= 2 \text{ Sines } 1^\circ\, 30' \times {\cdot}5$$
$$= {\cdot}0261769 \times 10 = {\cdot}261769$$

The pitch circle radius of pinions

$$= \frac{7}{60} = {\cdot}1166$$

and the radius of periphery

$$= \text{Cosine } 10^\circ \times {\cdot}1166 + \text{Sine } 10^\circ \times {\cdot}1166$$
$$= {\cdot}1143 + {\cdot}0202 = {\cdot}135$$

and diameter

$$= {\cdot}135 \times 2 \quad {\cdot}27$$

leaving the pinion on the smaller side by ·27 — ·261 = ·009, which proves the method.

Remark.—It is always more safe to have the pinion on the smaller side, because a depth with such a pinion and sufficient clearance can never stop.

The Line of Centres.

To find the line of centres to a given wheel and pinion, we have to find the pitch circle radius of the pinion, and make this the third term in a proportion, the number of wheel and pinion the first and second, and the radius of the pitch circle of the pinion x, and then the line of centre will be equal to the pitch circle radius of the wheel, plus the pinion.

Example.

A wheel of 60 teeth has to be pitched into a pinion of 6; radius of pitch circle of wheel 4·75. Find the line of centres. Let radius of pitch circle of pinion $= x$, then

$$60 : 6 :: 4{\cdot}15 : x$$
$$x = \frac{4{\cdot}15 \times 6}{60}$$
$$= {\cdot}475$$

and the line of centres

$$= 4{\cdot}75 + {\cdot}475 = 5{\cdot}225.$$

The same holds good for depths with any other numbered pinions. We have only to put the number of the pinion in the place of 6 in the second term of the last example.

A number of practical problems can thus be solved.

Example.

Given the line of centres $= 4$, to find the radius of a wheel of 60 geared into a pinion of 8.

We know that the sum of the pitch circle radii is to either part, as the sum of the teeth and leaves is to either the teeth or leaves. Hence we obtain three terms, of a proportion of which the quantity to be found is the fourth.

Let radius of pitch circle of wheel $= x$, then

$$(60+8) ; 60 :: 4 : x$$
$$x = \frac{60 \times 4}{68}$$
$$= 3{\cdot}529$$

and radius of periphery

$$= 3{\cdot}529 + \frac{3.529 \times 3{\cdot}1416}{60}$$
$$= 3{\cdot}529 + {\cdot}1847 = 3{\cdot}7137$$

Again, given the line of centres and radius of periphery of a wheel, to find the number of leaves in the pinion (quoting from last example) Number of wheel teeth$=60$, radius of periphery $= 3{\cdot}7137$, line of centres $= 4$, number of pinion leaves $= x$.

By third method (M. Grossman's), the pitch circle radius of wheel

$$= 3{\cdot}7137 - \frac{3{\cdot}7137 \times 3}{60}$$
$$= 3{\cdot}7137 - {\cdot}1856 = 3{\cdot}528$$

Pitch circle radius of pinion

$$= 4 - 3{\cdot}528 = {\cdot}472$$

then

$$3{\cdot}528 : {\cdot}472 :: 60 : x$$
$$x = \frac{{\cdot}472 \times 60}{3{\cdot}528}$$
$$= 8$$

Conclusion.—In treating on depths, we have endeavoured to impart as much practical information as possible, and in a form that is in harmony with the object of the course. There are many points which may be further pursued with advantage, but for the present must leave untouched, and apply ourselves to the section of escapements.

(*To be continued.*)

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 151.)

We have dwelt somewhat longer upon these works because they are important as illustrating the bronzist's art at a period when, although sculpture had sunk very low, a movement was about to take place which eventually led to throwing off the trammels of Byzantine mannerism. The introduction of northern pointed architecture and its accompanying system of ornamentation speedily followed. We have, indeed, little else left to us of bronze works of that period in Italy, with the exception of some bells, and probably some few of the eagle-formed lecterns—one of which, that in the church of St. Ambrosio, in Milan, is of very early date. The number of crosses and altar candlesticks is somewhat larger; but these are more rare of Italian than of German or Flemish production.

Among bronze works of the latter end of the twelfth or early thirteenth century, mention must be made of the wonderful candlestick in Milan Cathedral. In design it is a mixture of Byzantine and Romanesque, while the sentiment and action of some of the groups and figures would suggest the earlier years of the thirteenth rather than the twelfth century. A cast, by Pietro Pierotti, of Milan, of this remarkable work is in the South Kensington Museum (No. 67—1). The bronze door of the Lateran sacristy is stated to be by Albertus and Petrus "Lausenensis" (of Lausanne), and of the year 1203.

The influence of the Pisan school under Nicola Pisano was the great motive change; the budding forth of the *renaissance* of the plastic art under modified classic forms and ornament, to which a picturesque element not derived from classic models and a religious sentiment which Christianity alone could impart were superadded. Giovanni, the son of Nicola, still further promoted the new movement, but it is to Andrea that we owe the greatest bronze work of the early revival.

The gates of the baptistry at Florence were, according to some statements, cast after Andrea's designs by bronze founders from Venice. We shall return to the consideration of this noble work.

The pointed style, which had thoroughly established itself throughout the northern and western countries of Europe during the thirteenth, the fourteenth, and fifteenth centuries, never took so firm a root in Italy. But the Italian artists, with that quickness of perception and appreciation which are inborn to them, modified and adapted the painted architecture and ornaments to their own ideal, producing thereby works of the greatest beauty, which unfortunately, however, frequently ignore the great principle of true "Gothic" art, viz:—construction, to which ornament is correctly made subordinate. The Italians pursued their own course; the regeneration of art in Italy was upon other principles and guided by another sentiment that that of the countries beyond the Alps; the old classic blood was still mixed in their veins, and the advancing flood of the aspiring northern style, broken into many streams by the Alpine barrier which it had to pass, was soon met and stemmed by the tide of classic revival. This in its turn flowed northward, submerging and drowning the better and more original (inaptly termed) "Gothic," and soon degenerated into an objectionable and nerveless pseudo-classic mannerism, overlaid by a fungoid and unhealthy growth of *rococo* scroll ornament. The same sentiment that influenced architecture as the leading art also modified the sculptors' and painters' style; these were again followed by the silversmith, the jeweller, and the potter. Their debasement was universal: and at last art and its appreciation fell so low as to sweep away monuments of a purer time, or to immure them beneath the weight of works which deface so many fine churches in France and Italy. Fortunately in England those earlier works were rather neglected than "improved;" this was not, however, the consequence of a better taste; for in architecture, the National Gallery and certain terraces in the Regent's Park—in sculpture, the equestrian bronze statues of Wellington and George IV.—in pottery, the productions of Spode—and in silver, the "kings' pattern" spoon, are extant witnesses to the poverty of an artistic capacity, and curiously inferior to some of the contemporary works in painting.

For greater convenience in the study of our subject, it will perhaps be well first to confine attention to the most important and abundant source of the great revival in the sculptors' art, Tuscany. That love for the production of works in bronze, which had led to such technical excellence on the part of their Etruscan forefathers as to make them the furnishers of armour, candelabra, vases, and other ornamental objects of that material, to the ancient world, even to Athens in the days of Pericles, after a long enervation, and perhaps stimulated by the works of Byzantines and of their immediate followers in the south of Italy, we now see first springing into new life by Andrea's production of the noble gate of S. Giovanni.

With the exception of the Cosimati family, sculptors and mosaicists of admirable taste, the Roman sculptors had sunk down to mere mechanics; and the Byzantine mannerism showed no progress. We know but little of the power which Merovingian taste exerted beyond the goldsmiths' art; and the Carlovingian influence had been short-lived. The Goths and Singobands would seem to have had no art of their own. But the awakening of dormant energies, wearied and sunk in the dark night of ignorance and discord, was, as we have already said, due to the inborn genius, fostered by a true appreciation of the works of antiquity, of the Pisan Nicola, son of a notary of that city, and born about 1205 or 1207. The works of this truly great artist, the father of *renaissance* sculpture, who during his active life laboured in various parts of Italy, aided and succeeded by his son Giovanni, spread far and wide the seeds of improvement in an art, which, gradually developing, produced much noble fruit three centuries afterwards. Nicola's work, like that of the Comacines and of the Cosimati, was for the most part in marble; indeed, the bronzes on his latest important undertaking, the fountain at Perugia, were cast by maestro-Rissi in 1277, after Nicola's designs. Of the works of Giovanni (his son and scholar), which, although imbued with the father's manner, were wanting in the original fire; we have none in bronze, a material which seems to have been reserved for his scholar Andrea, not his blood relative, although as an artist greater than he. Andrea Pisano da Pontedera, the son of Ugolino di Nino, advanced beyond the architectonic trammels which had bound the works of his masters, though with golden cords, and entered the more poetic atmosphere of allegory, steadied nevertheless by a well-balanced propriety and earnest simplicity of composition, and imbued with pathos. Andrea was born in 1270, and worked first, when young, in the school of Giovanni as an apprentice; afterwards he seems to have gone to Venice, where it is possible that he may have gained from Byzantine workmen some knowledge of the art of bronze casting; for soon after his return we hear of him as the best sculptor in that material in Italy. He made a bronze crucifix for Clement V., which he sent as a present to that pope through his friend Giotto. His greatest work, the gates for the baptistery of San Giovanni, was modelled by him in 1330; the inscription upon them, "*Andreas Ugolini Nini me fecit* A.D. MCCCXXX," referring to the time when the model was ready. It took him nine years completely to finish them in bronze. These noble doors now hang on the south side of the Florentine baptistery, and are surrounded by a rich frieze, subsequently modelled and partly worked by Lorenzo and Villuno Ghiberti; they are divided into twenty large panels and eight smaller, the former representing events in the life of St. John the Baptist, the latter having allegorical figures of the Virtues. The designs for these admirable compositions have been attributed by Vasari and other writers to Giotto, Andrea's friend, and doubtless the influence of the mind and works of the great painter had its effect on Andrea. But in truth sculpture was in advance of painting at that time, and we see no reason to doubt that the invention of these admirable groups, so full of sentiment and purity in expression, so natural and truthful in the telling of their story, so easy in the pose and elegant in the drapery of the figures, and elaborated with such painstaking and technical ability, emanated from the mind of Andrea, as their execution was due to his superintendence and handiwork. Almost all we know of Andrea is learnt from these gates. He did work, chiefly architectural, at Venice; modelled some bas-reliefs for Giotto's campanile, and some statues for the façade of the duomo: a Virgin and Child for the Bigallo, and one for the Campo Santo at Pisa; another for the façade of the Orvietan duomo, on each side of which is the figure of an angel in bronze, cast by Lorenzo Mailani. He died at Florence in 1345. The technical and artistic knowledge, conveyed to so many by the production of these gates, which were the admiration of the signory and people of Florence, led to the formation of a school of sculptors in bronze at that city, who, following or leading, as the case might be, the spirit of art in their day, continued to flourish for upwards of three centuries.

(*To be Continued*).

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Construction of Timekeepers.

Delivered to the Board of Longitude, March 7, 1805.

Continued from page 14.

ARNOLD'S TIMEKEEPER.—Continued.

Q. How are the above-mentioned balance-springs made; that is, how are they brought to, and known to be of, a proper size, for each different watch; how turned into their proper shape, hardened, tempered, &c.? Is it necessary to attend particularly to the evenness of the wire? And if so, how is it known to be of a uniform thickness throughout?

A. I do not (*from experience*) pretend to know the exact proportionable size of balance-springs. I have made chronometers with springs of the same length and material, some of them making or containing six or seven turns, others nine, ten, and even twelve; consequently differing considerably in size, and yet performing equally well. I should imagine that the best size would be such as that the spring might impel the balance in the centre of percussion, which will be between the centre and circumference of the balance, according as the weight may be disposed. The springs of hard-rolled wire are turned into their proper shape by winding them on a cylinder or mould, and screwing each end fast. The cylinder being heated by a blow-pipe until the wire becomes blue, it is taken off, and the ends turned in by a pair of bending pliers, or by drawing them over a round broach. Gold springs are brought to their shape by the same process, only that the mould, which may be of steel, is made blue instead of the wire. Or if the mould is of brass, the screws which fasten the wire may be of steel; and when they become blue, it will be the same thing as if the mould were of steel.

ARNOLD'S ESCAPEMENT.

Springs are hardened by being made red-hot upon the cylinder, either by a blow-pipe or small charcoal fire, and then immersed in water or oil, and tempered by heating the cylinder with a blow-pipe until the wire becomes blue. There is a very great difference in steel; some sorts will be harder and more elastic at a blue than others at a yellow, and some again will bear letting down below a blue. It also happens sometimes that the very same piece of steel is of better quality in one part than another. The ends may be turned in by a pair of bending pliers made hot, or the mould may be cut down or spiralled at one end for the first turn of the spring, and it will come off with that end ready turned in. The balance-stud, into which that end is fixed, may be made moveable or to shift—that is, to lengthen or shorten, so as to meet the curve of the spring, and then fastened by two screws. The other end-turn of the spring might also be fastened in the same way; but as it may require to be shortened, to find the isochronat place, the curve will be continually altering, and must be replaced by the pliers, so that it will probably be useless to do it by the mould.

I think it necessary that the wire should be as even as possible. I do not suppose that any wire was ever of a uniform thickness, but its deviation from uniformity may be known by drawing it through a parallel gauge. The best way I know of to make it as uniform as possible is to grind it between two planes of hard steel with oil-stone dust.

The chronometer, No. 36, which was tried by the Astronomer Royal, five-and-twenty years since, had, and still has, the same spring of tempered steel. Everard's chronometer, No. 68, had, and still has, the same spring of gold: and the marine chronometer, No. 82, had, and I believe still has, a spring of hard-rolled steel. Experience is in favour of all three. The length of the spring of No. 36, pocket chronometer, was about eight inches; No. 68, about the same; No. 82, marine chronometer, sixteen inches, and of equal thickness from end to end. I think the gold and tempered steel will retain their identity longer than the other.

Q. What is the necessary length of a spring which shall contain that certain place? and how do you select that place or part from the whole?

A. That certain place is contained many times between the length of five inches and seventy, of and between which lengths vast numbers of springs have been made. Those places are selected from the whole by continually shortening, as fully described in the method of adjusting the long and short vibrations.

Q. As you do not recommend tapering the spring, but in the case of there not being room enough for a spring of a sufficient length, is it necessary to have the balance spring of equal breadth or thickness, or, in other words, of equal strength in every part? If that is the case, what means do you use to make it so, since scarcely any two following inches of the same wire, as it comes from the hands of the wire-drawer, are of the same strength, and that a spring made of it, without preparation, would be compounded of various powers?

A. I only recommend tapering for hand-rolled wire, but where there is perfect or great elasticity there is no occasion for it. The best-rolled wire will not require it, unless made very short and overstrained, as may be the case in flat and fashionable chronometers, where there is not sufficient room. The tapering is chiefly wanted at the bottom turn next the balance stud, which, from its spiral shape, is strained more than the cylindrical turns.

Wire drawn through the plates where the holes are gradually smaller, will be of more equal thickness than rolled wire, unless the mill is excellent, as for that purpose it ought to be. The wire should be as equal as possible, but none is perfect, and all springs are and will be compounded of various powers, so long as we remain short of perfection. We can only come near it.

Q. Is there any difference in the action of the expansion pieces when constructed of brass and steel of different qualities? and, if so, what qualities are best, and how chosen?

A. I make use of good flat steel and good Dutch brass, and having found it answer, never tried any other.

Q. How are the expansion pieces turned into their proper regular form? and how is the brass made to unite properly to the steel?

A. The expansion pieces are turned into their proper shape by a pair of hollow-mouthed pliers, and then heated to make them retain that form; and the brass unites to the steel by heat without any solder having to my knowledge been made use of—at least, during the last three-and-twenty years.

Q. What should be the relative thickness of the brass to the steel, and how obtained?

A. I make the brass twice the thickness of the steel, which thickness enables the brass to bend the steel easily, and I obtain it by measuring it as near as I can.

Q. Will any difference arise in the final performance of the watch if the steel is hard, soft, or tempered, or from being hardened or left in its natural state?

A. I cannot speak as to the difference, because I have always left the steel soft.

Q. Why does a machine measure time differently in different positions? Is it a defect arising from the imperfect execution of the escapement or other parts of the machine? and, if not, what other cause generates this sort of error?

A. Theoretically, from the unequal weight of the balance only; and if the escapement was void of friction, it would be practically so. With a good and well-made escapement, the inequality lies almost altogether in the balance.

Q. How are the detent springs made and tempered and placed in their proper positions? and what particulars are necessary to be observed in the making and placing them?

A. The detent springs are filed nearly to their proper substance, then hardened and tempered to a blue, sometimes not so low, according as the nature of the steel may be, and afterwards ground to their proper strength. The locking-spring is then drawn nearer to or farther from the verge, so as to make the locking pallet hold each tooth of the wheel at an equal distance from the impulse pallet, after which it is steady-pinned, so as it always may, if taken out, be returned to its place without further trouble. The unlocking-spring is only to be in contact with the locking-spring at the part where it is pinned fast, and at the end of the locking-spring.

The spring should lock the wheel as light as possible to do its duty, and the unlocking pallet should raise the unlocking spring as little as possible to do its duty. The spring should point to the centre of the verge, and lift equally forward and backward; the end of the unlocking-spring should be left rather shorter than the other part of it, to resist wearing.

Q. How are the lifting, locking, and main pallets made and applied to their proper places? and what particulars are necessary to be observed in placing them, and how obtained?

A. The lifting, locking, and main pallets are of steel, hardened and tempered, with dovetails cut for the admission of jewels, of which their acting parts are composed. The situation of the lifting and main pallets to each other is such as that when the wheel is unlocked it may fall upon the main pallet before it comes to the line of centres, and to have as little drop as may be without butting.

(To be Continued.)

The Discrimination and Artistic Use of Precious Stones.*

By Professor A. H. Church, F.C.S.

(*Continued from page* 15.)

RED STONES.—Continued.

MOONSTONES and white sapphires, it should be noted, in which there often lurks a faint opalescence, accord well with rubies; but it must be kept in mind that the size of the colourless stones which are to be associated with rubies in such designs as those which I have named, is a matter of much moment. It is a mistake to attempt to match the colourless and the coloured stones in respect of size, and generally of shape also. One should be smaller than the other. Large rubies with small moonstones, or small rubies with large moonstones, and similarly, square stones with round, and oblong stones with round, generally produce happier effects than square with square, and oblong with oblong. Pearls accord with rubies, not only by reason of their colour relations, but also on account of their shape. In the case of rubies cut *en cabochon*, brilliant-cut or square step-cut diamonds will be found to yield very satisfactory combinations. A border of small brilliants or roses is a usual and a useful mode of setting off the qualities of a ruby. The colour of a pale stone is heightened by contrast with the colourlessness of the diamonds; the richness of a rich stone is enriched, and a small stone, if surrounded by stones still smaller, becomes magnified in proportion.

Next to the ruby, amongst the red stones, comes the spinel or balais ruby, an entirely different mineral species, without any pleochroism, and inferior in hardness to the true ruby. The scarlet, aurora red, and flame-coloured spinels are the most beautiful; those which verge upon crimson, purple, and violet, looking dull and black at night, but showing very delicate and often rare hues by day. Red spinels accord well with small brilliants, or with larger pearls or moonstones. A fine aurora-red spinel looks well when surrounded with delicate foliage of white, orange, and black enamels. Step-cutting, similar to that employed for emeralds, accords best with the optical qualities of this stone. A biconvex lenticular form may be so adapted to this stone, as to throw a good deal of soft and rich colour into a specimen which would otherwise have had little beauty to recommend it. What richness of hue the finer examples of red spinel may show is to be studied in two specimens in the Townshend collection, South Kensington Museum, Nos. 1,326 and 1,327.

From spinels the passage to garnets is easy. But it is not really difficult to discriminate between the two species, even when the colours seem the same. If you have a ruby, a spinel, and a garnet together, the first will scratch the second and the second the third. The ruby will show two colours in the dichroiscope, the spinel and the garnet only one. The spinel will exhibit no black bands like those belonging to the red garnet, when viewed with the spectroscope. And there is a blackness, due to much absorption of light, in many of the facets of a garnet, as seen from the "table" of the stone, which will not be observed in the spinel. The garnet, unless of remarkable size or quality, will hardly be deemed worthy of being mounted in the same costly way as the ruby or the red spinel, but it may be said that the same general treatment suits all these red stones. Yet there are two ways in which garnets have, for long and in many places, been treated, to which I may legitimately refer here The plates of garnet so largely found in Anglo-Saxon and Celtic jewels have remained, in the majority of cases, intact to the present day. They afford, in their breadths of soft, rich colour, a pleasant contrast to the minute filagree, granulated, and enamel work, with which they are generally associated. The other employment of the red garnet (and it may be traced back to a far earlier date than that I have just cited) is as a carbuncle—not necessarily foiled at the back. Cut *en cabochon*, slightly hollowed behind, and laid on a plain gold surface, the light, as of a glowing coal, quivers in the midst of a good stone. There is a lovely disc of antique gold set with five carbuncles in the Gold Ornaments Room at the British Museum. There is a round carbuncle boss in the centre; then four long pointed arms, much like elongated pears, radiate from this centre, alternately with a somewhat similar series of *repousse* arms, beaten up from the disc of gold, and bordered with nurled wires onlaid. There is not much work in the piece; the intrinsic value of gold and garnets is quite small, but the effect is delightful; simple, yet rich; solid, yet elegant. Can the same praise be honestly given to modern garnet-work? Can we feel a genuine satisfaction either in the design, the execution, or the effect of a compound big carbuncle of eight lobes, with a six-rayed star rivetted into the midst of it, the aforesaid star being of hard, poor, glittering, much alloyed gold, and containing a number of irregular fragments of defective diamonds? The star soon gets loose, and, later on, the diamonds begin dropping out. But I will not pursue the history of the piece any farther, and I will refrain from calling your attention to other obnoxious modes of using the carbuncles—say, in a ring with a sham gold knot on either side.

Amongst orange and yellow stones I would, unhesitatingly, assign the first place to the yellow zircon—a stone which is sometimes found of a hue which may be aptly described as that of transparent gold. Next to this comes the cinnamon stone, or essonite; and then we may place the rich sherry-coloured Brazilian topaz—that kind which yields, when heated, the finest rose-pink stones. Yellow sapphires take an almost equal rank with the best topazes, and then the chrysoberyl follows, and, at some distance, the yellow beryl. Few colour combinations have been attempted with these yellow stones; puce-coloured spinels I have found to associate with the yellow sapphire very happily, but there are some enamels which answer equally well. Generally, a design of pale blueish-grey enamel, with minor details wrought in buff and white, developes the richness of gold-coloured stones.

There are two green stones about which something ought to be said—the emerald and the tourmaline. I do not sympathise with those persons who regard the green of the emerald as vulgar. It is too easy to construct a vulgar, coarse ornament out of emeralds, even if they be of fine quality-- so much I will allow; but the emerald, step-cut, and judiciously and quietly mounted, possesses a rich and refreshing colour, just sufficiently dichroic to show passages of bluish-green with the green. Green tourmalines are much more markedly dichroic, and it is much to be regretted that, with rare exceptions, the patrons of the jeweller's art still remain ignorant not only of the peculiarly rich and varied qualities of the colour of the tourmaline, but even of the existence of this gem-stone. With moonstones, or with grey and white enamel, long prismatic tourmalines, carefully cut, afford a delightful colour combination peculiarly fitted for larger pieces of personal adornment, such as pendants and brooches. The so-called green garnets of the Urals, especially those which are of an olive or pistachio green, are lustrous and fiery stones, but their softness precludes their use in rings. The same objection holds good with regard to the lovely stone, the peridot; but this species occurs frequently of large size, and so is well adapted for employment in jewels not subject to much attrition. It is a dichroic stone; it accords well with small puce, violet, or indigo spinels, also with black and white enamel.

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* A Lecture, delivered at the Society of Arts.

Passing over, for lack of time, the varieties of beryl, known as aquamarine, the green and blue beryl, the blue topaz, and the green sapphire, I must linger for a few moments over the sapphire. The dichroism of this stone, strong though it is, does not appear much in the cut specimens we usually see; but I do not doubt that the twin beams of diversely-coloured light which this stone transmits, one azure blue, the other greenish straw, contribute to produce the peculiarly rich quality of its velvety softness. There is a glittering coldness in all the imitations of the sapphire; the *timbre* of their colour—if I may borrow a word from music—is harsh and unsatisfactory. So a recent imitation, a kind of lime-spinel, made artificially, exhibits apparently the right colour, but it is flat and uninteresting. To my eye, the difference between a true sapphire and a false one is the analogue of the difference between a piece of leafage in wrought iron and the same piece in cast iron. As to the arrangement of the sapphire in jewellery, so much depends upon its depth of colour and its precise hue, that a general rule would be fallacious. Unless it be pale, when certain green tourmalines go well with it, the sapphire may be most safely associated with pearls, diamonds, moonstones, or white topazes, the cutting and size of the stones being carefully studied.

(To be Continued.)

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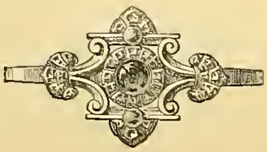
Sale of Old English Plate.—A large collection of old English silver and silver-gilt plate, in spoons, salvers, tankards, teapots, candlesticks, and a variety of other useful ornamental articles, all of which bore the hall-marks of the time, was sold last week by Messrs. Christie, Manson, and Woods, bringing very high prices. A silver spoon, with long handle, and one smaller, both hall-marked 1702, and a rat-tailed gravy spoon, hall-marked 1714, sold at 34s. per oz.; four plain round salt-cellars, h.m. 1703-1707, at 48s. per oz.; a pair of candlesticks, fluted stems and octagonal feet, h.m. 1694, 36s. per oz.; another pair similar, h.m. 1696, 21s. 6d. per oz.; a chocolate pot, h.m. 1706, 23s. 6d. per oz.; a coffee-pot, 1713, 25s. 6d. per oz.; an octagonal teapot, h.m. 1713, 44s. per oz.; several tankards, of dates varying from 1659 to 1708, sold at from 15s. to 31s. per oz.; a jug, engraved with foliage and birds, h.m. 1691, at 51s.; and a two-handled cup, 1692, at the same price per oz; a candlestick on triangular foot, h.m. 1615, brought 57s. per oz.; and a tazza, embossed with grapes and flowers, h.m. 1658, 61s. per oz. The plate of foreign make, of which there were about 60 lots, brought smaller prices, and was not sold at per oz. A platina tea-service, partly gilt and enamelled with flowers, in a case, from the San Donato sale of 1870, brought only £32; a silver inkstand, chased with scrolls and shells, sold for £49. A silver-gilt beaker, chased and inlaid with silver coins, £44. A silver-gilt tankard, with enamelled bands of Boucher subjects, and the lid of agate, with the handle as a figure, 9½ inches high, £61. A pair of parcel-gilt sconces for three lights, chased and embossed with figures, £66. Amongst the jewels sold were a pair of large black pearl drops, which brought £225. A beautiful black pearl pendant, of six pearls, with fine old brilliant in centre, and a large pearl drop, £305.—*Pawnbrokers' Gazette.*



Golconda.

There is a report that one of the diamond mines which were included under the celebrated name of Golconda has been discovered to be in a workable state, and that an effort will be made to revive an industry that has long disappeared from Central India. In the vicinity of the modern town of Hyderabad are the ruins of the hill-fort and city of Golconda, which was three centuries ago the residence of an independent prince, who held under his sway a vast tract of country, from the sources of the Godavery and Kistna to where those great rivers enter the Bay of Bengal. But famous as Golconda was at this period for its strength, and for the dynasty which occupied its throne, it was still better known as the centre of the richest diamond-producing district in the world. At Golconda itself diamonds were, however, never found. They came from various villages in the Kistna valley, which lies at a considerable distance south of that place. Among the principal of these were Karnul, Kullore, Kudapah, and Mallavelly, while at Partiall—still within the Nizam's dominions—they reach the most northern point at which they are found. But although found in the alluvial bed of the Kistna and in the quartz of the neighbouring hills, the diamonds were always taken to Golconda to be cut into shape and polished in its workshops, and hence it came that they were designated by its name. The exact time of the decline of this industry is not ascertained, nor is it known with any degree of certainty whether it was due to natural causes or fortuitous circumstances. It may, of course, be that these mines have been practically exhausted, and they were worked for quite ten centuries before they were abandoned—and in that case we are not likely to see much of a revival of an ancient and profitable industry. On the other hand, there is some reason for the belief that they were only ceased to be worked in consequence of the Mogul invasion under Aurungzebe, who plundered Golconda, and whose departure was followed by the troubled period which ushered in the new power of the Nizam. At the present moment none of these mines are worked, except that at Partiall, which barely pays it expenses; although all the rest are included in either the Northern Circars or the ceded districts of Bellary and Kadapah—both being now under British authority.—*Globe.*

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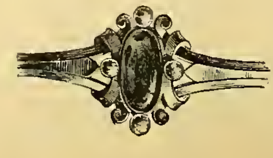
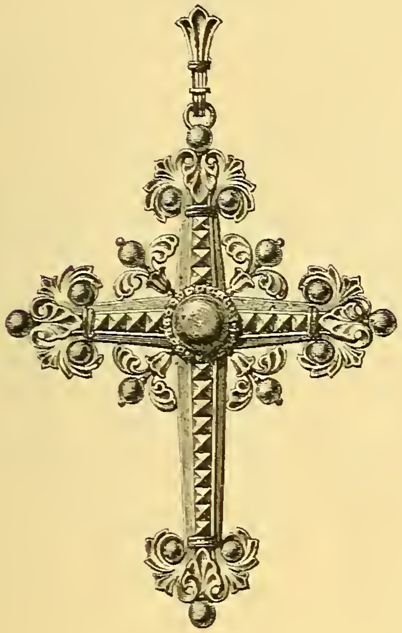
Description of Designs.

No. 12. Cross of coloured gold, with different coloured enamels.
,, 13. Locket of coloured gold.
,, 14. Locket of coloured gold, with different coloured enamels.
,, 15. Earring of gold, in different colours.
,, 16. Brooch of coloured gold.
,, 17. Earring in gold, in different colours.
,, 18. Chain of coloured gold.
,, 19. Ditto ditto.
,, 20. Ring of coloured gold.
,, 21. Brooch of silver or gold, of different colours.



MONTHLY SUPPLEMENT OF DESIGNS.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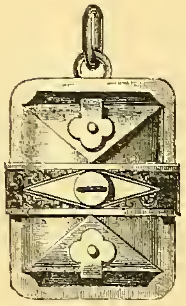
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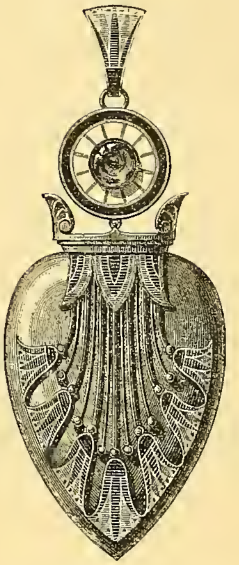
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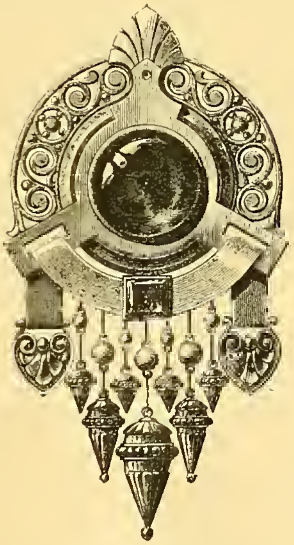
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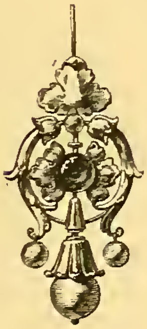
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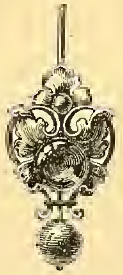
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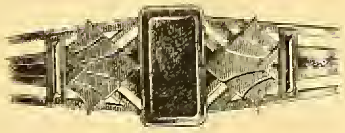
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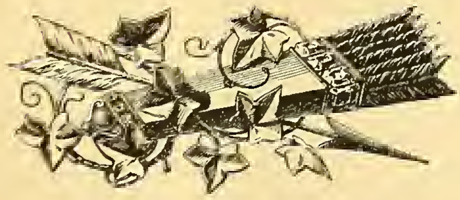
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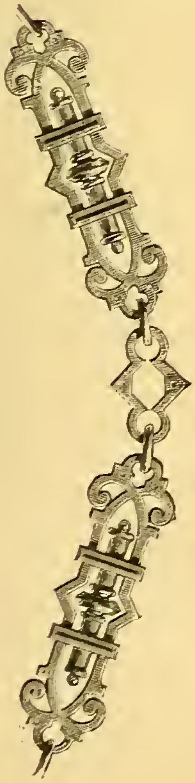
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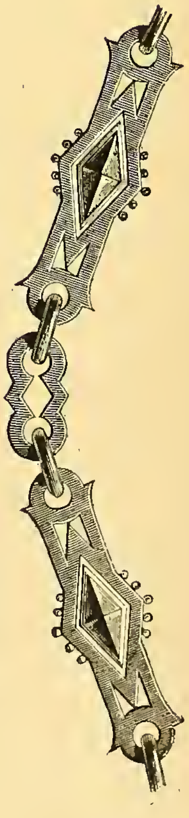
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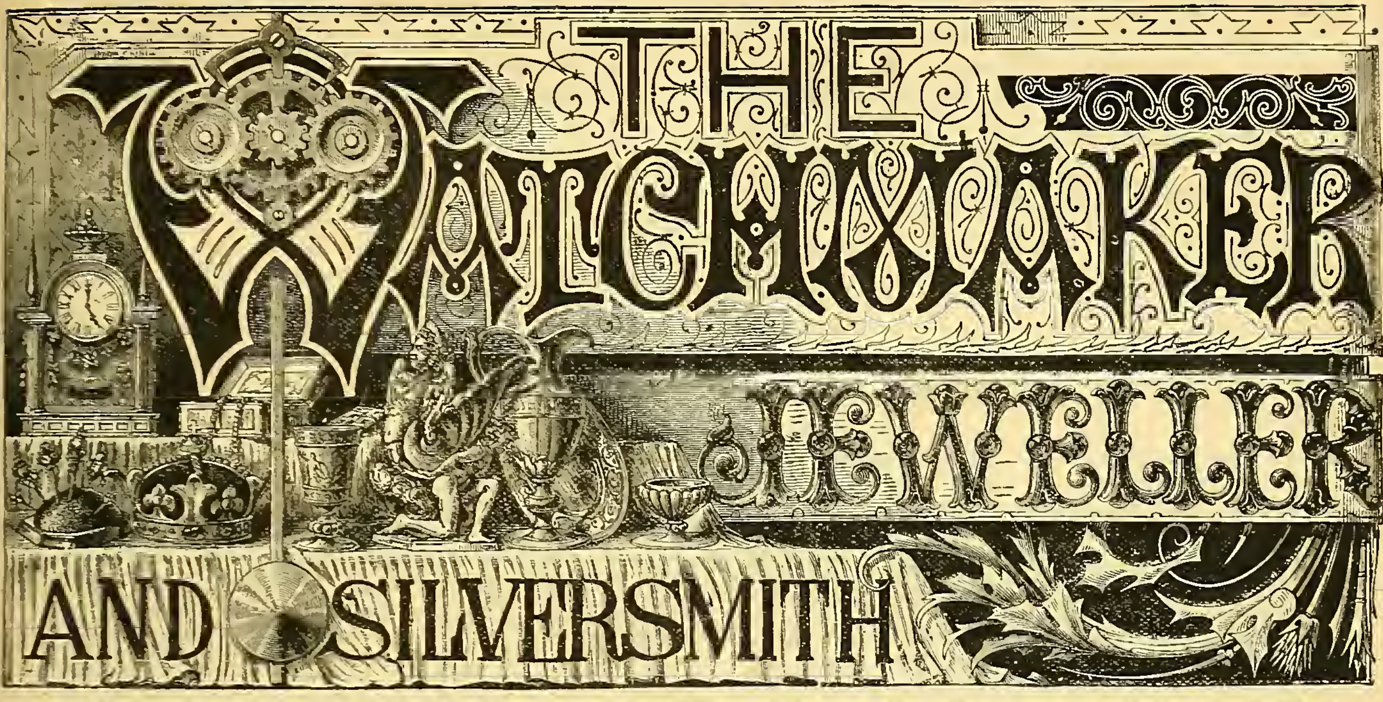

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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English Keyless Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—In my last paper I referred to a keyless watch of primitive construction which had no means of setting the hands, or any turning back action, neither of which contrivances are actually necessary for every-day use, but the necessity of studying convenience of wearers soon brought improved plans into existence.

The Swiss, with ready ingenuity, utilized the principle of the well-known Brequet key, the pinion being sunk in the pillar plate under the winding wheels. This arrangement seemed to be quite beyond the mechanical powers of our Lancashire movement makers, and for fully ten years imported movements were largely used by the bulk of English manufacturers, until, by competition, the quality so deteriorated that they ceased to be any recommendation to a watch. This remark does not apply to repeaters, chronographs, and other complicated high-class movements, which have a position of their own.

The chief practical objection to the Swiss plan is, that it is rarely possible to get the pendant in the middle of the band, and the attempt to do so often results in the production of an ugly case.

Our own workmen adopted the "rocking bar" principle with the bevelled wheel and pinion. This was ultimately produced in Lancashire until, at the present time, it is quite the exception to use a foreign movement for a professedly English watch. There are many foreign imitations of this principle, but they are easily detected by experts. These cheap movements, both English and Swiss, are produced in large quantities, and are quite a distinct class of trade from the Clerkenwell "hand made" winding which is demanded by our leading houses, and with the construction of which I propose to deal. It should be understood that I am purposely abstaining from referring to fusee watches, which demand a chapter to themselves.

The first thing a keyless maker should do is to have the lower centre and barrel holes put properly in, in order to prevent the risk of the depth shifting if they are done afterwards, and then to determine the sizes of the wheels and motion which will be used; they should be so arranged that the intermediate wheel throws naturally into the winding one, and also that the wheel for setting hands does not move the minute wheel in throwing in, otherwise the hands are likely to be shifted without the wearer being aware of it. The turning back action must be carefully noticed. Many a keyless watch has puzzled both the maker and the wearer, in consequence of the set hands wheel not being sufficiently free of the minute wheel.

The best way of going to work is to plant the bevelled and minute wheels first, and also to put the winding wheel on the barrel arbor; then score off the depth for the intermediate and set hand wheels in the bevelled, and make cross depths with the two small wheels, just missing the winding and minute wheels. Screw the rough piece of steel for the bar on the plate by the centre hole, and drill it off from the holes in the plate.

Previously to doing this, it will have been necessary to turn out the plate for the bevelled wheel, and a keyless maker requires to be very skilful in the management of the mandrill, if he aims at doing a good class of work. The old-fashioned English tool with the wheel and treadle has been quite thrust aside by its Swiss rival, which many workmen, accustomed to the former, are quite unable to acquire the knack of using. Its action is quite as mysterious to them as the sewing machine is to those who have never attempted to avail themselves of its assistance. The foregoing remarks equally apply to escapement makers and finishers, and it is a good investment for every young man to master the use of the Swiss tool. In keyless work, so many small places require to be cut out of the inside edge of the pillar plate, and nothing looks worse than to see the edge broken through.

Before the rocking bar, to which I have referred, can be proceeded with, the position of the set hand push piece must be determined (it usually comes between the third and fourth minute of the dial) and the edge of the plate turned out, the corner of the rocking being filed to fit up into it. After the holes are made in the bar it can be taken off the plate, filed into shape, and the studs made for the two wheels, which, it will be remembered, are left out of action. The holes in the plate are then lengthened, in order to allow them to act properly in the winding and minute wheels, and the turning back action ought to be perfectly safe.

The click may now be planted. This is the most important part in a going barrel watch; should it fail, the spring flies back in the barrel at the risk of spoiling the stop work and breaking the lower third pivot. Some adopt two clicks and springs, but this plan has been but partially adopted; and if the click drops freely into each tooth without any dragging over, it is seldom any trouble arises.

I have not yet referred to the cutting of the wheels. A keyless maker labours under a disadvantage if he cannot do this himself, and yet there are many who do not. The sector is an all important adjunct in this department, and any departure from its rules results in the production of a rough winding.

In making a winding to a new movement, I should first select a suitable motion and use it as a factor. At one time the teeth for keyless wheels were preferred coarse, but it has been proved that fine teeth are equally as strong, if properly pitched and sectored, while they undoubtedly give a safer click action.

While writing, I have before me a 16-size open face winding, which has just come in from the keyless maker, and I will describe the cutting of the wheels as I find them. The minute wheel is in 36, cannon pinion 12, and the barrel wheel contains 58 teeth, exactly the same strength as in the minute, while the bevelled wheel, which comes down to the same position in the sector as the barrel wheel, has two teeth less (56). The intermediate winding wheel contains 28 teeth, and only comes down to 28½ in the sector. The set hands wheel has 24, and stands at 24½, while the bevelled pinion is also over sectored to the same extent. Now, I know that the sectoring has been carefully attended to by the keyless maker, and these apparent variations from correct sectoring are done for a special purpose, the result attained being easy winding and setting; of course, I am assuming the depths to be correct and the wheels truly and evenly cut, and also that the centre arbor is smooth and well fitted.

Some examiners attempt to correct a rough winding by filing the leaves of the bevelled wheel and pinion, but this is a mischievous proceeding. I recently had a winding through my hands, the bevelled pinion to which, instead of being over-sectored, contained two teeth too many, and the fault was endeavoured to be overcome by filing the teeth narrower; but the sector revealed the source of the mischief at once, and a new pinion was the only cure.

Another thing I would mention is, that keyless wheels should not be hardened twice over. Those sent from Lancashire are a fit temper to use, but some fourteen years ago I doubted this, and the double hardening caused some teeth to break, very much to the annoyance of the recipients of the watches.

There are many other points connected with constructing a keyless work, which my time and space prevent me from entering into, such as the making and planting the return spring, filing the hollow in the plate for the stud, &c.; suffice it to say, as a general axiom, that a plate should be distressed as little as possible; some workmen, however, seem to delight in taking liberties in this respect.

A keyless workman should be an adept in the art of making screws; screw-making is a very important branch of watchmaking, it being well known that there are "screws" and "screws." At the present time, one of our best balance makers is seriously inconveniencing his customers on account of his inability to get a sufficient supply of screws for best balances. I asked him if it would be ultimately impossible to get them made by machinery, and he replied that he thought not, but the machine would have to be superintended by a master, who would have to give his concentrated attention to seeing that each one was perfect. In the meantime, he assures me that a good screwmaker for balances could readily earn £3 a week.

Keyless screws require greater skill in one respect than balance screws, because the latter only have heads and taps, whereas the pivots to the former are as important as the taps, and a workman who can produce a really good, well-fitting screw has a right to be regarded with respect, as it proves the existence of qualities which can be advantageously extended to other branches of work. The amount of judgment required in getting a full tap without unduly straining the steel, is very considerable, and it is necessary to keep the hole in the screw-plate perfectly clean and well oiled all the time the screw is in course of construction, otherwise the tap will be torn off. Most of the directions I gave to escapement makers apply to this topic; everything that is used should be as true as possible, and as much pains taken with the taps, as with the screws themselves; and with it all, there are few who attain the proficiency which is required for making the screw and tapping the hole to a chronometer detent, or for the gold piece of a lever to a double roller escapement. I must now, however, bring this month's paper to a close.

I am, &c.,

JAMES U. POOLE.

33, Spencer Street, Clerkenwell, E.C.

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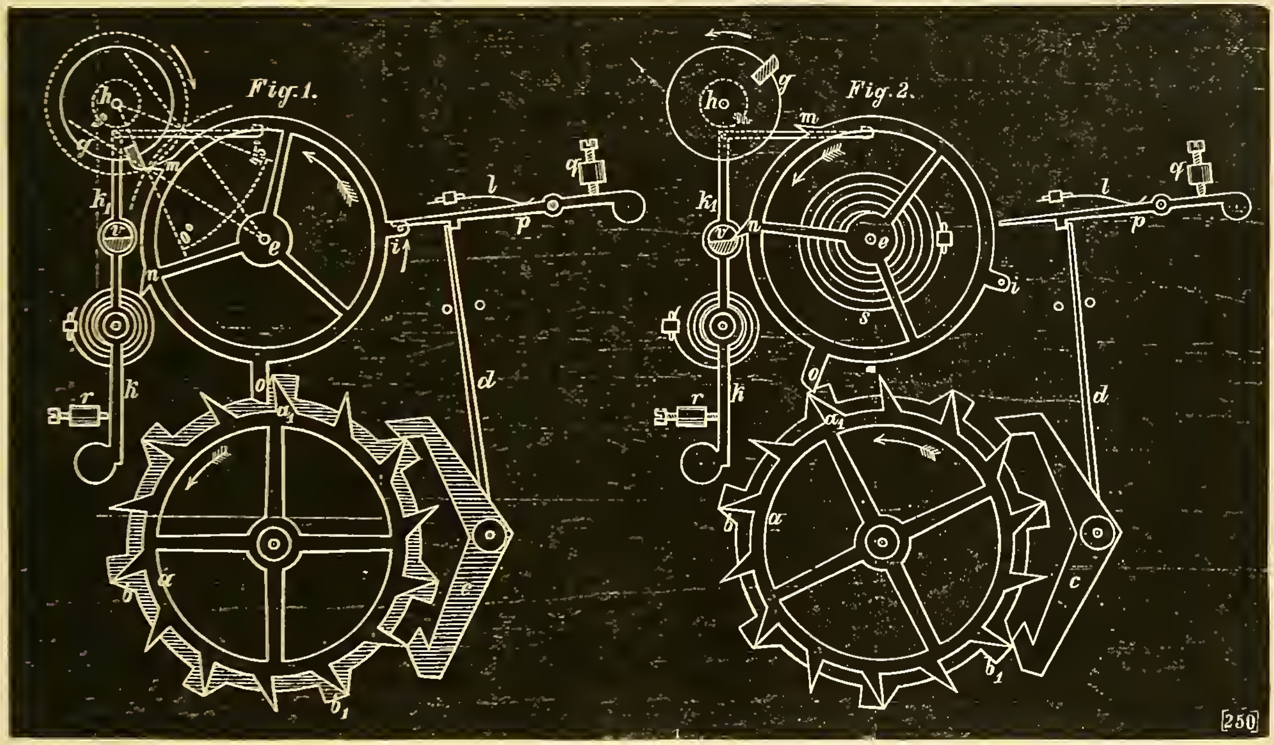
A watchmaker in Newcastle, Penn., says a Pittsburg paper, has completed a set of three gold shirt studs, in one of which is a watch that keeps excellent time, the dial being about three-eights of an inch in diameter. The three studs are connected by a strip of silver inside the shirt bosom, and the watch contained in the middle one is wound up by turning the stud above, and the hands are set by turning the one below. The liliputian machine works with a pendulum, and the latter acts in all positions, even if it be turned upside down.

Independent Chronometer Escapement.

With Constant Impulse and Independent Locking.

Invented and Patented by J. H. Eisele, Kiel (Germany).

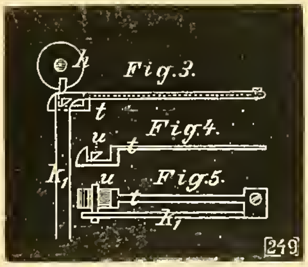
For the following description of this interesting escapement, we are indebted to our German contemporary, *Allgemeines Journal der Uhrmacherkunst*:—Many inventions for a constant force chronometer escapement are on record, but most of them failed from the variations in the unlocking resistance. To render such an escapement perfect, the unlocking resistance of the train must be constant also—which is difficult to obtain and requires many additional parts—or the unlocking must be independent from the impulse. Mr. Eisele has chosen the latter, and in his escapement the unlocking of the train is effected with great ease at the moment when the impulse-lever leaves the impulse-roller on the balance-staff, so that irregularities in the train are in nowise transferred to the escapement.



At h is the centre of the balance-staff, which, like every other chronometer escapement, carries a large and a small roller: the former, g, receives an impulse at every second vibration; the latter, h, unlocks the detent $k\ k$. The unlocking arrangement itself, which does not consist of the usual gold spring in this escapement, is covered in Fig. 1 and 2 by the roller g, but its construction will be seen in Fig. 3. The constant impulse in the impulse-tooth of the large roller g is effected by the tooth on the circumference of a wheel-shaped body e, which, besides the tooth m, has the projections n, o, and i; on the arbor of e is a collet for the balance spring s, the producer of the constant impulse. The detent $k\,k$ is continually brought back to rest at the banking screw r by a small spring, which holds the locking jewel v for the locking tooth n on the circumference of e.

Fig. 1 represents the escapement at the impulse moment. The tooth m is on the point of dropping from the jewel in the roller g; in the lifting, the pin i approaches the discharging arm p, and at the same moment as the tooth m leaves the roller, the lever d has become free also, the tooth a of the train is released, and falls on the projection o, and lifts until the locking tooth n has passed the locking jewel v (with very little turn of detent) the tooth a then drops again from o; the tooth n lies on the locking plane of the detent, and the projection o goes in consequence also slightly back—this is scarcely perceptible; the mechanism is then again at rest, as represented in Fig. 2, while the balance has received an impulse, and executes a dead beat.

On the last pinion of the train are two wheels, a and b, firmly fixed together; the higher standing wheel a, with 14 pointed teeth, has no connection with the pallets c, its object is only to act on the lever o, to secure by that means the tension of the spring s. The 7 wedge-shaped teeth of wheel b rest alternately on one of the two arms of the pallet-shaped body c, the planes of the pallets have not a locking but an unlocking inclination, so that the point of the lever d continually lies on one side of the projection at the discharging arm p. The circular planes on the teeth of the wheel b, and likewise in the pallets c, prevent any false movement of lever d. The release of d and the passing of a tooth of wheels a and b, happens with perfect security. The unlocking by the small roller h is very ingeniously contrived. The unlocking-spring t (Fig. 4) does not lie parallel with the body of the detent $k\ k$, but is fixed at right angles at the end of it. The advantage of the arrangement is that in the going back of the balance (here from left to right) the small jewel in the roller h leaves the spring t very quickly, the latter bends only very slightly towards the centre of the detent and rests then again on pin u, which is fixed in detent $k\ k$. The disadvantage of this device lies in the increased weight of the body of the detent, which must be considered in pocket-chronometers. Figs. 3 to 5 represent the separate parts of the unlocking spring, and the end-piece of the detent $k\ k$.



Machine Work versus Hand Work.

A Reply to Mr. James U. Poole.

(*Continued from p.* 21.)

No. IX.

APPRENTICESHIP is my theme. Some apology is due, and every apology is offered to the reader for this departure from the subject under consideration. My reason for this departure lies in the fact that Mr. Poole frequently refers to apprenticeship—generally in the past tense, and I think he intimates that the present system of training is ready to vanish. Referring to another matter, he says he can, "without egotism, claim to have received a thorough practical training as a workman." I regret that I am compelled to take an unfavourable view of this training, but at this stage of the controversy it will be unnecessary to state that flattery is not my failing, and I much prefer by faithful words to incur the displeasure of every reader of my paper, than by deceitful overtures to allure them into a course of conduct that I well know to be fraught with injury to their best interests.

Perhaps there is no question in watchmaking at the present time that is of paramount importance with that of training the young men who are to become the artizans of the future; it therefore demands the utmost earnestness and plainness of speech.

During the last few years it has been a popular thing to show the incompleteness, and to denounce in very strong language the old system of apprenticeship; and, so far as watchmaking is concerned, we have for the most part remained unmoved, while others seem to have expended all their force in invective. Before we cut down, root and branch, a tree which has borne some excellent fruit in the past, it might be well to enquire if some of the branches could not be pruned and others grafted. I think some of the readers will be disposed to say with the writer—

> "In youth it sheltered me,
> And I'll protect it now."

Without binding myself entirely to a line of conduct, I submit for your consideration that it would be well to continue on an improved basis the old system of apprenticeship. The old system is too expensive, both as to premium and term of service; the youth is too much exposed to the selfishness of his master. The theoretical part of his business may be said to be entirely neglected. During his apprenticeship the youth must be placed in connection with a technical school, to pursue those theoretical studies that are hardly compatible with a house of business and the routine of a workshop. In our system of training we do not sufficiently consider what is being done by other countries*. We are too much disposed to measure our attainments by our own standard, instead of seeking the best standards.

Much of the failure in our system is due to excessive drudgery and neglect of recreation. When a youth has wearied every limb by working at watchwork, let him feel the recuperative power of fresh air; let him exchange the bench and its tools for the bat, the ball, and the bicycle. When he is tired from the study of Saunier, let him seek soothing sentiments in Sam Slick. Recreation means re-creation, and anything which tends to restore the wasted tissues of body and mind is laudable and right. Education means drawing out, not dragging out; we must allure if we would lead the way. The effort that is being made in London at the present time is spasmodic; it is more like the administering of drops of water in a fainting fit, than the copious and refreshing draughts of health. In catering for apprenticeship we must remember that the School Board boys of to-day, who are to become the artisans of the future, are made of very different material to the David Copperfields of thirty-five years ago. Their minds are already charged with text-books—I may call it the dynamite of science—and it will depend upon the mould into which their pliable natures are cast as to whether the explosive elements they contain shall be used for the weal or woe of the nation. The relation of master and apprentice is the nearest to parental relationship, and any system which fails to extend to the youth a fatherly care will assuredly fail. The danger to which we are drifting, is the building and depending *solely* upon large institutions for Technical Education. No doubt great Colleges and great Cathedrals have done much for the spread of learning and religion, but much of the vantage ground acquired by these institutions has been derived from completing that which was commenced in small schools and little churches, spread all over the country, and if we are to derive the full benefit from the institutions that are now being erected in Finsbury and South Kensington, we must diligently apply ourselves in establishing a better system of training in all watch manufacturing centres throughout the country.

It is a fact well worth a wise man's consideration, that no apprentices are being taken for new watchwork, and many of those who have recently completed their term have found more lucrative employment as railway porters or bricklayers' labourers; and, from what I can learn, it appears there is not one of the young men in Mr. Curzon's class that contemplates working on new English watchwork; they are learning escapement-making, for the purpose of repairing escapements. In this respect at least they are wiser than their teachers, though we are told to look to them to "sustain the prestige of English horology." In times past we were something more than mere watch jobbers!

It needs no prophet to point to the future of English watchmaking just now; one of two events must certainly take place: either the industry will die out, just as the clock trade has done, or we shall, by judicious alterations in our system of manufacture gain new life, and secure to ourselves a fair share of the manufacturing trade, not only in watches, but also in clocks.

RICHARD WHITTAKER.

(*To be continued.*)

P.S.—In reply to Mr. Poole's postscript, August issue, I am at a loss to understand how Mr. Curzon can, with any degree of fairness, authorise Mr. Poole to repudiate the paragraph, page 2, second column. His consent to my request was perfectly spontaneous, and in order not to exceed his wishes, I not only read the manuscript to him, but read and gave to Mr. Curzon a corrected proof of my paper, and he expressed his approval of it; a third party present will bear witness to this. I should be sorry to take the unwarrantable liberty of inviting anybody to witness the operation of a machine without the owner's permission. The first word of dissent I heard from Mr. Curzon was on July 21st, when he did not repudiate the paragraph, but said he could not "remember" it, and in the same breath began to describe the severe cross-examination he had met with at the Institute, mentionin especially the cross-questions of Mr. Glasgow and Mr. Poole. I am sorry if Mr. Curzon's generous response should have subjected him to any inconvenience, and I am also sorry that he should have shown a want of firmness in the presence of the leaders of the Institute. I may add, the paragraph in question is in keeping with the general tenor of Mr. Curzon's conduct. The willingness he has shown to explain matters of this kind is one of the prominent features in his recent lecture. Mr. Poole's postscript sounds like the discharge of a farewell shot. I suppose the dettant controversy is at an end. It remains only for the reader to give judgment.

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* I will furnish you with an example of the bad effect of this neglect. At a going barrel competition one of the competitors sent as his invention a going barrel with the mainspring hooked in with a pivoted brace. When he showed it to me I told him it had been in use for more than eight years in America, and was being sold in large quantities in this country, and he assured me up to that time he had not examined an American going barrel. See a full account, *Horological Journal*, Vol. XXI., p. 114. If this state of things continues, we must lose our position in the councils as well as the commerce of horology, and we shall do well to pause before we rush to the front and arrogate to ourselves the right to give judgment in all matters connected with the trade.

Erratum.—On page 21. second column, line 2, instead of "Military *importance*" read "Military *impotence*."

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The City and Guilds of London Institute.

Examination in Watch and Clock Making, 1882.

Preparatory Evening Classes will be formed for the above, according to the new regulation, in Ordinary or Pass, and Honours in October, at St. Thomas Charterhouse School of Science, Goswell Road. Teacher: I. Herrmann, Registered Teacher of the Institute, and fully certificated in Honours; formerly Teacher at the Horological Institute, &c.

Syllabus for Pass Class.—Mechanical Terms and Ideas—Fundamental Principles—Friction—Composition and Resolution of Forces—Mechanical Power: Application to Watches and Clocks—Great Works—Trains—Depths—Outlines of Clock and Watch Escapements, New Principles, Properties, &c.

The articles published in the *Watchmaker, Jeweller, and Silversmith* will be mainly followed as a text.

Syllabus for Honours Class.—Practical Trigonometry—Logarithms—Motives—An Inclined Plane—A Circle—About a Fixed Centre—Simple and Compound Pendulum—Balance—Epicycloidal Teeth Watch—Clock—Chronometer and Gravity and Remontor Escapements—Timing, &c.

The following Prizes are offered:—

In Pass—	1st	£3 and Silver Medal.
	2nd	£3 and Bronze Medal.
	3rd	£2 ,, ,,
	4th	£1 ,, ,,
	5th	Bronze Medal.
	6th	The *Watchmaker, Jeweller, & Silversmiths' Journal* Prize of £1 1*s*.

To be awarded by the Teacher.

Honours—	1st	£5 and Silver Medal.
	2nd	£5 and Bronze Medal.
	3rd	The *Watchmaker, Jeweller, & Silversmiths' Journal* Prize of £1 11*s*. 6*d*.

To be awarded by the Teacher.

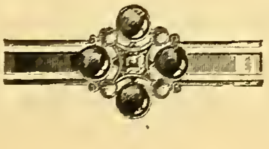
To make the tuition as effectual as possible, it is intended to form an additional class for Drawing, which members of both other classes can join.

The Prizes and Certificates gained by the students of Mr. Herrmann's class at the last examination will be presented at a meeting to be convened by the City and Guilds Institute in November.

Five Students passed 1st class, three 2nd class, and one obtained a Prize of £2 and bronze Medal.

The only Students of the classes at the British Horological Institute that have obtained Medals were under I. Herrmann's tuition.

Particulars of I. Hermann, Watchmaker, Lordship Lane, Dulwich, S.E., or of the Editor of this Journal.



Bronzes.

By C. D. E. Fortnum, F.S.A.

Continued from page 31.

MEANTIME, Siena had also given birth to artists of high ability: the chief among them, Maitano di Lorenzo—the architect, from its first stone to its entirety, of that magnificent casket in marble, the cathedral of Arvieto. Round this wondrous structure clustered in loving toil, like bees about their comb, a very crowd of artists and artisans, aided by the voluntary labour of admiring citizens. Their great leader, the "capo maèstro," was Maitano, architect, sculptor in marble and in bronze, mosaicist, and philosopher, who has left us on this façade the history of our faith so writ in marble that "he who runs may read." But these are not of bronze; and we may not dwell on the artistic beauty of "the four piers." We must look upwards to see the symbols of the four evangelists in that metal, which were cast (as it is said) by him in the last year of his life, 1330. His son, Lorenzo, who afterwards went to Perugia, was also a bronzist. The seated group of the Virgin and child was cast by Maestro Buzio di Biaggio, after a model, as it is said, by Andrea Pisano. Not, however, till 1371 did Siena's greatest sculptor see the light—Giacomo della Quercia, the son of the goldsmith, Pietro d'Angelo di Guarnerio. In his hands both marble and bronze were at command, although his more important works at Bologna and elsewhere are in the former material. This was by accident, for had he succeeded in his competition with Ghiberti for the second pair of baptistery gates, his fame would have been perpetuated in metal rather than in marble. One work by him in bronze is the *rilievo* panel on the font in the Sienese baptistery, which he had been commissioned to execute in 1416, but which was not finished till 1430, and represents the calling of St. Joachim: a fine work ably grasped. Quercia died in 1438. Of other Sienese sculptors who worked in metal, Il Vecchietta (Lorenzo di Giovanni di Lando) was a scholar of Quercia, and executed a silver statue of St. Catherine, now lost; he worked in other materials as a sculptor, and also as painter, architect, and goldsmith. The bronze tabernacle, adorned with cherubs, above the altar in the duomo at Siena, is by him; and a statuette, the risen Saviour. In the collection at the Bargello, in Florence, is the recumbent draped effigy of Marino Soccino, by Vecchietta, a striking and pathetic work, but somewhat hard and dry, as though cast from the dead model. Other works by him at Siena are, the statues of St. Peter and St. Paul, at the Loggia de Mercanti; and a bronze Christ, and angels bearing candelabra, in the Chapel which he built and endowed at the hospital della Scala, the former of which he inscribed, "*Vecchietta, pictor, pro sua devotione fecit hoc opus.*" He died in 1480, at the age of 78.

The artists of Siena, during the course of the sixteenth and subsequent centuries, when her government was merged in that of Florence, were of minor consequence, and need not detain us.

Returning to Florence, which city had learnt and profited so much by the works of the Pisan school, followed by her own Arnalfo and Arcagna, we shall find that two of her greatest artists did not appear upon the stage until the end of the fourteenth century, some 150 years after the great revival of sculpture by Nicola Pisano. These were Lorenzo Ghiberti (1381-1455), the leader if not the creator of the pictorial school; and Donatello, made of sterner stuff, more realistic and naturalistic in his treatment of plastic representation.

(*To be Continued.*)

Repairing Swiss Watches.

By Hy. Ganney.

(Continued from page 23.)

No. IX.

THE cutting of hollows in pinion faces and rivets is, perhaps, the finest test of skill with the graver, as a sharp, well-pointed, yet strong graver must be used, and the graver cutting clean, without root or roughness, leaving the hollow a bright grey. It was the practice years ago to polish hollows, but there is no skill in the operation, and it has gone out of fashion. An ordinary facing tool was simply turned and filed small to fit the hollow, and the hollow received its form from the tool. The value of hollows to rivets and pinions when the pivots are close to them is very great, as they prevent the oil running away from the pivots and shoulders. Should an escape wheel and pinion be lost, they can be replaced by sectoring the fourth wheel for the size of pinion, or a pinion whose leaves are rather smaller than the same number of teeth of the wheel may be tried in the depth tool, taking the depth from the fourth and scape holes. The scape wheel corresponds in number on the gauge with the hole in the cylinder gauge in which it fits; but, before using, it will be as well to see if the cylinder passes freely between two teeth of the wheel, and that one tooth of the wheel has shake sufficient for freedom in the inside of the cylinder. This may be done by holding them in the fingers, or by putting them in the depth tool at the correct depth. The height of the wheel and its suitability may be seen by turning or filing a small piece of brass like a ferrule, and laying it in the sink of the scape wheel. By placing the wheel on this, and putting the cylinder in place in the watch, the brass collet must be thinned until the wheel acts correctly in the cylinder, the bottom of which must be free of the wheel, and the tooth acting safely on the cylinder edges, by gauging the thickness of the piece of brass and bottom jewel-hole in the Douzieme gauge, and then deducting the thickness of the hole itself, we obtain the right height for turning the pinion from the bottom shoulder to the seat for the wheel, and by putting the scape-cock on, and placing another piece of brass between the top jewel and the bottom and gauging the distance, we obtain the distance at which the top pivot and shoulder must be, rather low than high, as the scape-cock readily lowers, but, if raised, it may foul the balance.

A very troublesome fault in some of the best class of Swiss watches is too great a vibration, causing the balance to strike the bankings. It is most often found in watches having wheel teeth with straight inclines. The more modern practice is to curve the acting face of the teeth, and a slight alteration of the tooth diminishing the incline at the heel of the tooth will always diminish the amount of vibration. A new hair-spring will sometimes cause the banking error. There is a tendency of late years to put too many turns in the hair-springs of horizontal watches. A large number of turns in a lever hair-spring is a great advantage, owing to the greater vibration necessary and desirable; but when the arc of vibration is small, as in horizontal and vertical watches, long springs do not have all their turns properly in action, and offering not sufficient resistance to the balance, allow it to travel greater distances too easily. A balance without the hair-spring strikes the banking at every vibration, and the number of turns and tension of the spring are the means to be used to prevent this. The vibration of the balance and the time-keeping qualities of the watch are more frequently destroyed by untrue and badly put springs. Repairs to springs, except of a trifling character, are generally false economy. An hour may be spent trying to reshape and flatten a bad spring in vain, which can be replaced in a few minutes by an expert hand possessing a good stock of springs, and nothing pays so well for keeping.

Upon our first introduction to repairing, we astonished our employers by putting a new hair-spring to nearly every job that passed through our hands; but objections against doing more than customers would pay for compelled us to desist, and we learned how bad springs and everything else may be in watch work, and yet, so long as they tick, they will time near enough. The want of a direct and easily perceived effect of good or bad work is much needed, as it is only at some remote period that either shows its effect. To replace an old hair-spring with a new one, another watch going to time should be on the work-board; and, having selected a spring by bending the inner turn, and placing it so that it binds or catches the cylinder, it may, by lifting it up with the tweezers, cause the balance to vibrate, the bottom pivot touching a smooth surface, such as the top of the glass oil-cup. By catching hold of one or more turns, and altering the position of the tweezers, the arms of the balance must be made to vibrate in unison with those of the watch going to time, which may be known by listening to one, and observing if the ticks correspond with the motion of the loose balance, or, by looking at both balances, see if they appear to travel together. If, when this result is obtained, the spring is still a suitable size, the size of the spring being reckoned from where it is held by the tweezers as a temporary stud, by this means a suitable spring can always be secured without the trouble of putting on the collet, and spoiling a number, and wasting time by mere guesswork, and watching second-hands for time, the spring being suitable, half the balance diameter being reckoned most correct; but, in a job, the position of the stud and index governs the size, and, placing the spring on them, an idea can be gained as to the desirability of fixing any otherwise suitable spring, taking off the pendulum collet from the balance with a fine-bladed knife forced under it. We put it on a broach, and resting both on a cork in the vice, we push out with a needle-point the pin, and throw it away. Fitting a fine, well burnished pin, we do not nip it off, except at the extreme end, where it is marked with a knife, taken out and cut off with the knife. One side of the pin, still on the wire, held in the pin-vice, is filed and burnished rather flat. Success in getting a spring on well will depend on the quality of the hole in the collet; if bad, it will necessitate much manipulation; if good, the spring is simply put in the hole. The end having been bent to follow the direction of the turns, the pin put in, and, by moving the pin-vice, we bring the flat side of the pin in contact with the spring, and it will be in a line by moving the pin. We then nip it off, or previously nick it with the knife and break it off, and then, with the tweezers or fine pliers, push it home. If too long, the pin must be filed, the safe edge of a fine file pushing the second turn aside enough to carefully file it away. A steady hand is the great requisite in springing.

Should a new collet be requisite, a new one must be made from a brass stopping, or they can be purchased in quantities at the tool shops, only requiring slitting, and the holes already drilled. The drilling of a hair-spring collet is not easy; in fact, it is the most difficult thing there is to drill, and if the drilling is made easier by drilling in both directions, great destruction of pivot broaches results. In attempting to open a hole that has two directions, a special soft and fine pivot breach is needed to commence the opening. Workmen who whistle and sing over the finest pivoting generally seem serious when drilling the collet, as drills stick and break, necessitating another collet, or a hole the other side, using the plugged hole as the place to slit the collet to give it elasticity. When the spring is firmly on the collet, the first turn cannot be too close to it, but it must not touch it, and must form a true or slightly expanding circle with it. It must then be placed in the turns, on an arbor, and revolved with the bow and looked at with the glass to see the spring revolves truly with the collet, and that there is no jumping action with it. If the eye of the spring is much larger than the collet, it will be difficult to make it revolve truly; but, in repairing a bad spring, many judicious touches with the tweezers may be given whilst it is on the arbor, and anything like a crank action of the spring and collet must be obviated.

The spring must be flattened in the same way whilst revolving, with the tweezers; but if properly put on, it will not want much altering, as all the alterations are made by bending the turns away from the first turn, which, being held tight, will have quite a different line of action if much alteration is required; if hardened and tempered springs are used, none of this bending can be done, and the correct placing of the spring in the collet hole, and testing it before it is made quite tight, are the only means, and the best means of getting it right; but in jobbing the circumstances are more accommodating, and high-class springing is not the rule on horizontal watches. To time the watch quickly, the same means used to select the spring may now be used with greater precision, and the spring left under control of the regulator, without previous trial. It is of great importance that the regulation pins and stud hole are in the same circle, and placing them near; if incorrect, they should be improved, or a good spring is transformed into a bad one, if these are left incorrect; a well fitted pin flattened, and left but little longer than the stud, the flattened pin in the pin vice will, by moving, bring the spring quite flat, if collet hole and stud hole are in the same plane, and save injurious manipulation with the tweezers. But as these things are seldom right, the ability to manipulate with the tweezers is most useful and necessary to the jobber. Good watches need no jobbing. The spring must be, when at rest, midway between the pins of the regulator, and, if true, as the circle is a diminishing one, it presses harder on the inner pin at the fast than at the slow, which is what is desired. Inattention to this point often causes regulators to be of no use, as the spring is often very free at the fast and bound at the slow, causing the watch to regulate the reverse way, or not at all. In some watches, owing to the bad arrangement, the hair-spring when right size and flat is in a direct line with the centre wheel, and when both wheel and spring are large, they touch. Lowering of the spring on the collet, or turning the collet, if much brass is between it and the balance, will effect a cure, and bring the spring under the wheel. Closing the turns and drilling a new hole in the stud, if that being badly planted causes the spring to vibrate too far in that direction, may improve it, or the stud may be put nearer the centre wheel, causing the spring to throw out in an opposite direction; or the outside turn may be altered to an overcoil or brequet spring form, which is the very best for watches, all other things being equal. Any amount of skill and management can be employed on the hair-spring, which is the soul of the watch, and aptness at that one job often constitutes the difference between good and bad watch jobbing. Considerable confidence is necessary, and a tendency to shirk the spring seems common amongst both makers and jobbers.

(To be continued.)

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Messrs. Deykin & Sons, Venetian Works, Birmingham, have just celebrated the centenary of the existence of their firm by a picnic to their employés and friends. Previously to 1854 the button trade was carried on exclusively at Venetian Works, but on the introduction of electro-plate in that year, that branch was added. In 1877, the manufacture of buttons was abandoned, and the electro-plate trade is now carried on exclusively.

A List of Watches, Watch Movements, Clocks, &c.

WE called attention, some time ago, to the collection of books, watches, watch movements, clocks, &c., the property of the Worshipful Company of Clockmakers, and now accessible to the public at the Guildhall Library. This Company is making every effort to use the small means at their command for the benefit of the trade with which they are connected, and by their gracious permission we reprint from their catalogue—ably and handsomely got up by their secretary, Mr. W. H. Overall, and printed for private circulation—a list of the specimens of watchwork. A visit to the Guildhall Library and Museum will prove very interesting and instructive, and no visitor from the country should fail to make use of the advantage offered.

Addis, Cornhill, London.

William, the son of Robert Addis, of Bristol; apprenticed to George Sims, May 1st, 1738; made free of the Company, February 3rd, 1745; elected on the Court of Assistants, April 2nd, 1759; served the office of Warden, 1761-3; Master, 1764-5.

1. Gilt Movement (partially to pieces) No. 2611.

Presented by F. B. Adams, 1869.

Andervalt, Pasquale, Trieste.

2. A Hydrogen Gas Clock.—The motive power of this clock is hydrogen gas generated by the action of diluted sulphuric acid on a ball of zinc. The gas, thus formed, forces upwards a bell-shaped glass receiver, which keeps the clock going until it nearly reaches the top of the coloured glass jar, when, by the action of a delicate lever, two valves are opened simultaneously—one allowing the gas to escape, thereby causing the receiver to descend, and the other permitting a fresh zinc pellet to fall into the acid. The same operation is repeated as long as the materials for making the gas are supplied, and this is effected without winding or manipulation of any kind.

Presented by William Wing, 1874.

Anonymous.

3. An Alarum, in a beautifully engraved and pierced silver case, silver dial, with enamel figures.

This has been constructed to be used in conjunction with a watch or time.piece, having a hollow square for the insertion of the fusee arbor; the watch so used driving the motion of the alarum.

4. A Silver Alarum, intended to be applied to the fusee of a watch.

5. A Gilt Open-face Watch, with gold dial, horizontal escapement. No. 16,023.

This watch plays a tune at each hour, and can be made to play at pleasure.

Presented by F. B. Adams, 1870.

6. A Small Octagon Watch, in a Crystal Case, engraved and gilt dial, hour hand only, with raised pins at each hour for feeling the time at night, called a "Touch Watch." A curious specimen of the art.

Presented by Mr. Auld, 1825.

7. An Oval Seconds Watch, with enamel dial, duplex escapement. An early specimen, formerly enclosed in a locket.

Presented by Messrs. F. B. Adams and Sons, 1849.

To be continued.

The Construction of a Simple but Mechanically Perfect Watch.[*]

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(*Continued from page* 22.)

For illustrating the advantages to be derived from this arrangement, I give the following comparative sizes:—

I have a good English ¾-plate movement, diameter 44m.; the total height of frame is 7·2m., the height of fusee 3·2m., and the height of barrel 2·65m.

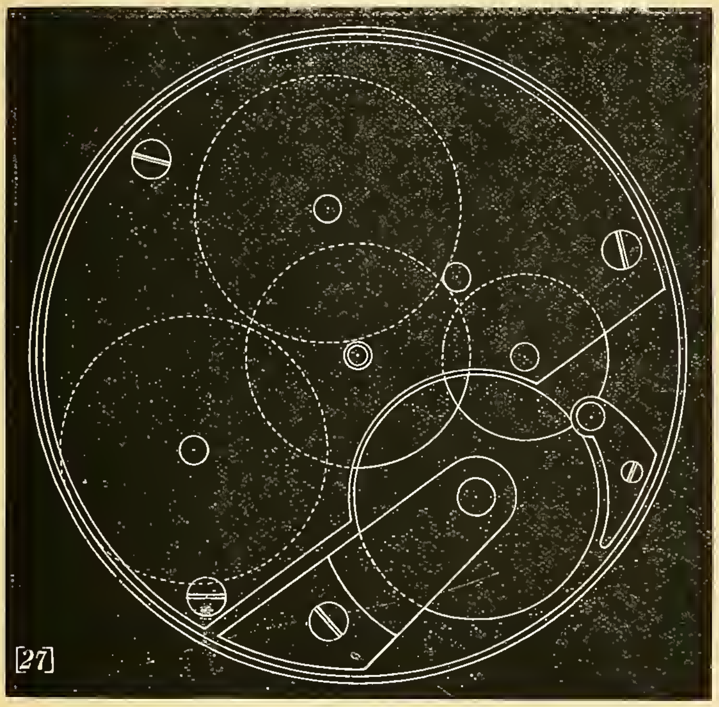

Fig. 30.

My movement, of the modified disposition, has a diameter of 46m; its height is also 7·2m., the height of fusee 3·8m., and that of barrel 3·9m.

The height of frame being equal in both cases, it will be evident that there is a considerable advantage in the arrangement I propose:—

	Height of Fusee.	Breadth of Spring.
In my movement	3·8m.	3·9m.
In the English movement.. ..	3·2m.	2·65m.
Difference in favour of the former	0·6m.	1·25m.

Compared to the English movement, the construction with the centre wheel above the fusee results in a percental gain in the height of fusee, of 18·74 per cent., and in the breadth of spring of 47·17 per cent. This latter is an increase of nearly one-half, and I think it may be considered a most essential improvement of the fusee movement. From the following description and drawing, the reader may conclude that this gain is not bought at the price of any loss in the solidity of some other part of the movement.

The third wheel, in a movement of this kind, must get its place at the dial side of the pillar plate, under the fusee wheel. In all other particulars there is no difference from the usual position of the acting parts.

121. The respective position of barrel and fusee in all the English fusee movements is also irrational, and ought to be inverted. This latter position of the fusee would save a considerable amount of friction on the pivots without a loss or disadvantage on any other side.

The pressure acting on the pivots of the fuzee in the English movement is, by this defect of construction, the highest attainable maximum. The diagram 32 represents the fusee wheel and centre pinion. In order to ascertain the pressure on the pivot, it must be supposed that the point of contact between the wheel and pinion at *f* is the fulcrum of a lever, on the other end of which *g*, the power transmitted by the chain, is acting. It requires no proof that the pressure on the fusee pivot *c* is equal to double the power exerted at *g*.

With the other plan of construction, illustrated by diagram 33, the fulcrum is the same at *f*; the power acts very near it, and the pressure at the pivot *c* will consequently amount to about a quarter of the power exerted at *g*.

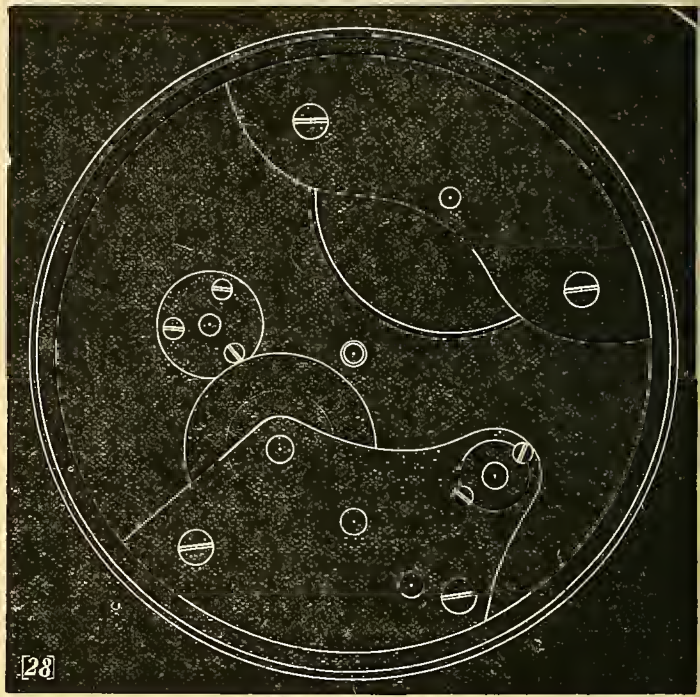

Fig. 31.

The difference of pressure in the two cases spoken of is as 8 to 1; and as the friction is in the ratio of the pressure, the advantage to be attained by this modification is considerable, though it must be remembered that the difference of pressure in the two cases is greatest when the chain acts at the bottom of the fusee, and diminishes towards the top of it; but even there it will be about as 4 to 1.

It is surprising that this arrangement, the advantage of which is beyond any doubt, and which is due to Julian Leroy, has not found any followers in England, the country of the fusee movement. It hat been employed so much the more by French and German makers.

The stopwork in a fusee movement is an absolute necessity. Even if the chain had an abundance of length, it would find no room for any superfluous coils on the fusee and on the barrel. The continuation of the winding beyond the useful extent for which, without the stopwork, there would be no control, would result in undue strain of the spring in the unhooking of the chain. The usual stopwork in fusee watches is too well known to require description. If well executed, its action takes place in a right angle and offers any desirable safety and soundness.

This stopwork, however, would not be applicable for a fusee movement arranged in the manner described in paragraph 121. There it requires a modification which at the same time improves and simplifies it. This modified stopwork has to resist to a tractional strain, and consists of a foot *a* and the flexible arm *b*: it must be placed in the direction of a tangent to the circle described by the fusee-cap, and at *c* it has a strong shoulder against which the strain of this former takes place. The further prolongation *d* extends in a straight line as far as to bring it in contact with the chain; and at this part it is made thinner and rounded off.

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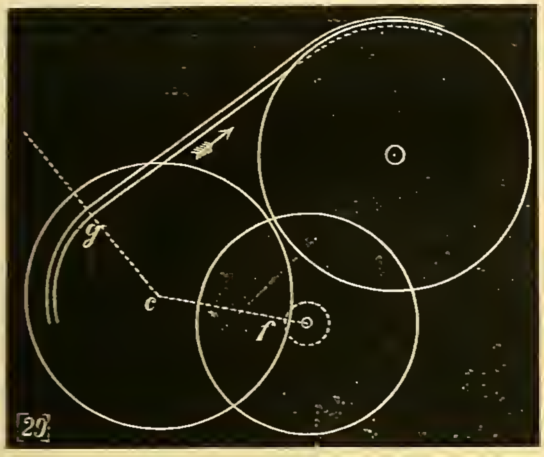


Fig. 32.

The chain, if nearly wound up on the fusee, lifts the flexible arm of stopwork towards the upper plate, till the fusee-cap comes to lie against it and renders further winding impossible.

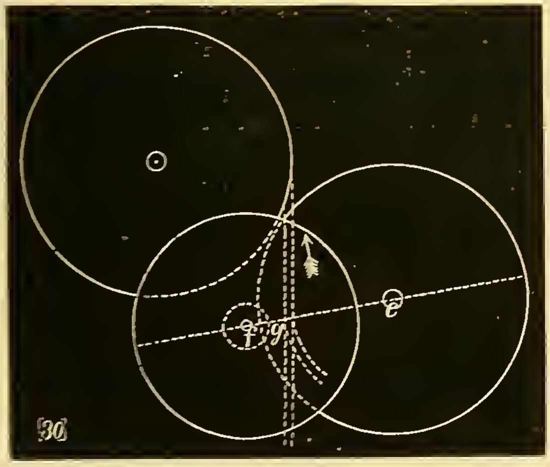


Fig. 33.

Another kind of stopwork is available for both arrangements of the fusee movement: it is not frequently employed, though it possesses all desirable strength.

It consists in a small sliding bar of steel *a* moveable in the direction of its length in a groove made in the upper surface of the fusee. This slide corresponds in height to the upper coil of the chain and must not be lower than that. By a weak spring *b* which is sunk into the upper surface of the fusee, the slide is kept back, so that its tail projects into the uppermost groove of the fusee. If the winding operation is nearly completed, the chain takes its place and pushes the slide inward, thereby pushing its other extremity *c* further out, so that it meets with a screw or pin fixed in the upper plate at suitable distance, thus preventing any continuation of the winding. This stopwork, of course, does not require a cap, but a thin plate is screwed to the top of the fusee to keep the slide and spring in their places.

The different stopworks illustrated in Figs. 11 to 15 are equally applicable for fusee movements, but in this case the wheel of the stopwork must be screwed to the plate.

Whatever kind of stopwork may be chosen for a fusee movement, it is very important to secure the delicate parts of train and escapement against the dangers of destruction resulting from the rupture of the chain. The freed end of the chain in those cases often strikes with great violence against the adjoining parts, and this must be prevented by a judicious arrangement of the pillars, or by insertion of a thin fence close to the periphery of the barrel.

(*To be Continued.*)

Soft Pinions and English Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—I have read with considerable interest the discussion which has been going on in your Journal in regard to soft pinions and other defects in English watches, and notably the communicattion of Mr. Fisher, in which he gives some sensible advice to English manufacturers, all of which I can fully endorse. But what interested me more especially in his communication was the statement that he always bought well-finished English and good Swiss watches (avoiding American), the latter clause of which I cannot very well understand.

Can it be that he is ignorant of the fact that the very suggestions he makes for the improvement of Clerkenwell goods have always been a leading characteristic in American watches (which he avoids), notably harder pinions and steel work, and so also with other faults which he points out in Clerkenwell work.

By the system adopted in American watch factories, those faults which are common to English watches are practically impossible. No wheel or pinion can ever be out of proportion to each other, or so planted as to give a bad depth, or that end-shake or side-shake, should ever be to such an extent faulty as to prevent the free action of the train, or that the angles of the pallets, or the action of the roller pin in the fork, can be other than they should be.

There is not much to be surprised at that the Waltham Company alone has found a ready sale for not less than one and a-half millions of watches, to say nothing of the immense number turned out from half-a-dozen other establishments working on similar systems, and to-day find sufficient encouragement to increase their force from 1,000 to 1,800, and are now extending their works to accommodate 2,500 hands. I have not written this letter without some knowledge of the subject, as I have been practically engaged in the watch trade for over fifty years, and am quite familiar with the defects in both English and Swiss watches, and the false system, or rather the want of any system at all, in their production.

I was also prime mover in the establishment of the American system of watch manufacturing, and for ten years, from 1850 to 1860, personally superintended all the details in the manufacture of 40,000 watches; and I will guarantee every pinion, including the cannon pinion upon which the set hand square is, and the barrell arbor, upon which is the winding square, to be as much harder than best Clerkenwell work is, as the best Clerkenwell work is harder than the commoner sort of Swiss work, and have no reason to doubt but that every watch of the one and a half million made by the American Watch Company to be the same. For these and many other reasons, I cannot understand how it is that English and Swiss watches are chosen by your correspondent, and American Watches avoided.

Respectfully yours,

A. L. DENNISON.

Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann, on Monday Evenings, from October 25th.*

(Continued from p. 30).

ESCAPEMENTS.

Definition.—The escapement is that section of a watch or clock which connects the train with the balance or pendulum, and converts the rotary energy of the former into the reciprocatory motions of the latter by intermissive action. Its work is negative in relation to the train, and positive in relation to the moderator (the term used by Saunier for balance, or pendulum)—that is, it checks the velocity of the former by imparting to it its own intermittent motion, and maintains the vibrations of the latter by alternate impulses. Its functions may be said to be twofold: the first commences at the end of the train, and terminates with the moderator as described; but the second stands in an inverted order. Its movements being contemporary with those of the latter, it becomes the joint agent with the train of registering the time occupied by a definite number of vibrations, and thus indicates the gain or loss of each one in relation to a fixed standard.

Since it is evident that that watch or clock will go best whose moderator makes equal numbers of vibrations in equal periods, we determine the value of an escapement according to the regularity with which it maintains the movements of the balance or pendulum.

Range of Treatment.—The subjects before us present a vast extent for mechanical and geometrical study, reaching beyond the point where, in the present course, we can at best hope to attain to. A fuller investigation requires the aid of trigonometry, which time will not permit us to take up for the present. The compiler of the programme and of the examination paper published by the City and Guild Institute has very successfully divided this matter into the three grades or classes, viz., elementary, advanced, and honours. Therefore, by following the plan put forth therein, and treating the most practical points by the aid of the few mechanical truths we have learnt, we hope to render the best service for the workshop and for the ensuing examination.

Classification.—Various modes of divisions can be adopted. Saunier has it in the order of "Recoil, Dead Beat, and Detached;† but I think it will serve us best to divide and subdivide as follows:—

Frictional Rest.

RECOIL.	DEAD BEAT.	DETACHED.
Clock Escapements, with Recoil	Graham	Gravity
	Pin Escapement	Remontoir
	Horizontal	Lever
Brocot, or Pin Pallet	Duplex	Chronometer
Verge		

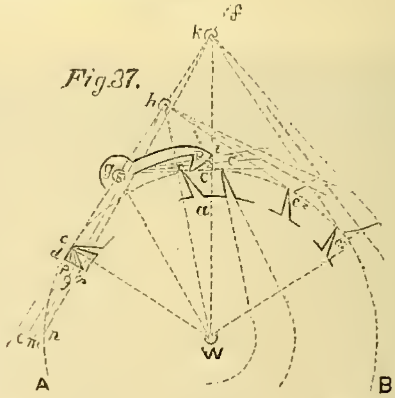
Recoil Escapements.—We attach the term "Recoil" to all those escapements in which the escape-wheel reverses the direction of its motion at the point where the supplementary arc of the balance or pendulum commences, as is the case in verge escapements in English dials, bracket and long clocks, &c. There is a slight recoil in the lever and chronometer, but it occurs at the end of the supplementary arc. The former certainly cannot be said of the duplex, though it has been classed among "Recoil," because the slight incidental recoil happens at the second of its three supplementary arcs.

Under this heading we shall restrict ourselves entirely to clock escapements. The verge has now nearly passed out of existence; indeed, the programme referred to does not mention it; therefore it would be a sacrifice of time to take it up. Neither is it possible to give separate attention to the various grades of recoils, from the dead beat on the one hand, to the most violent form on the other; but, by a study of the principles involved in the "radius of impulse," "impulse angle," and "angle of recoil," we shall be able to form some estimate of their several values, and to arrive at some solution to the problem, why some clocks go so much better than others of apparently the same construction.

Impulse Radius of Pallets.—From the common "Drum" to the "Graham," pallets of every degree of "span" are used; what practical end is served by these variations? This question we will first endeavour to answer.

Saunier, quoting M. Wagner,* has shown that long pallets give no advantage, on the contrary, that the gain is with short ones. It can be shown that in pallets with constant angles, if friction is neglected, the moments of long and short pallets are equal.

To a given wheel, the breadths of pallets of long or short radius, measured on the periphery of the escape-wheel, are equal, because the space occupied by each one is half the span of two teeth, minus the drop. Also, for constant angles, the arcs vary as the radii; and, assumed that the centres of motion of the pallets lay on the tangent drawn to the tooth in contact with the impulse plane, it follows that for pallets of every span to a given wheel, their respective centres must lay along this line.



Let Fig. 37 represent sections of a wheel and pallet. W is the centre of the wheel, and A B an arc of its periphery; c is the point of a tooth, and $c\,f$ the tangent to its radius, W c. Therefore, to a wheel of a given number of teeth, whatever span of pallets we employ, the centre of each one would lay somewhere in $c\,f$. Let g, h, and k be the respective centres of three different spand or sized pallets, then W g, W h, and W k represent their several lines of centres; and, given that their lifting or impulse arcs are equal, then $\angle c\,g\,o = \angle c\,h\,m = \angle c\,k\,n$. Also, let c represent that point on the impulse plane of the pallet where the impulse commences, and let $c\,d$ be the measure of half the span of two teeth, minus the drop; then for every pallet whose centres are indicated by g, h, and k, d is the position of their respective delivery edges when passing the periphery of the wheel, and, therefore, $d\,p$, $d\,q$, and $d\,r$ will be the respective arcs described by the edge of each pallet, represented by d, and hence also $c\,p$, $c\,q$, and $c\,r$ represent the driving planes of three different-sized pallets, but equal angles of rotary motion.

It is evident that $\angle p\,d\,f = \angle q\,d\,f = \angle r\,d\,f$, and

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[†] Article 4.

[*] Modern Horology. Article 230.

that in small impulse angles of 2, 3, or 4 degrees, for all practical purposes, *p d*, *q d*, and *r d* may be considered perpendicular to *d f*; and, therefore, *p d c*, *q d c*, and *r d c* right-angled triangles, and *d c* a side common to all. *f c*, being the tangent to W *c*, represents also the direction of the circumferencial force of the wheel acting at *c*, which is parallel to *d c*, and perpendicular to the base of either triangle. These conditions supply us all terms necessary to find the moments of *c p*, *c q*, and *c r*, about *g h*, and *k*, *c g* being $= g\,h = h\,k$ approximately.

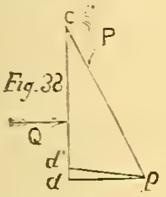
Fig. 38

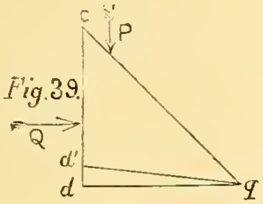
Fig. 39.

Let Figs. 38, 39, and 40, represent these triangles movable in the direction from *p* to *d* (Fig. 38); let P represent the circumferencial force of the wheel, and Q its effect in the direction of *p d*.* We know that

$$P : Q :: p\,d : d\,c :: q\,d : d\,c :: r\,d : d\,c$$

(see Figs. 22 and 23, p. 130, Vol. VI.), and Q × by *c g*, *c h*, and *c k* gives the moments about *g*, *h*, and *k* respectively.

These quantities can be determined by construction.

Describe a circle, representing the periphery of an escape-wheel of 30 teeth, with a radius of 5 inches. Setting off 30 equal divisions for the points of the teeth, the angle contained between any two of them $= \frac{360}{30} = 12^\circ$ Now, pallets spanning 5, 8, and 10 teeth (minus drop) will have their centres in the points of intersection of tangents drawn from points in the circle, representing $4\frac{1}{2}$, $7\frac{1}{2}$, and $9\frac{1}{2}$ teeth respectively $= c\,c^1$, $c\,c^2$, and $c\,c^3$ (Fig. 37). This will give *c g*, *c h*, and *c k* = 2·54, 5·, and 7·69 respectively, which is practically in ratio of 1, 2, and 3.†

By the protractor, mark off angles at *g*, *h*, and *k*, with *g c*, *h c*, and *k c* = 4°, and let the arcs contained by these angles, drawn with the radii *g c*, *h c*, and *k c*, represent the bases of the triangles (Fig. 38, 39, and 40).

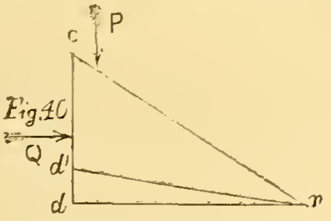
Fig. 40

It will be found on construction that they measure ·1177, ·3489, and ·5373 respectively. Allowing 2° for drop, then *d c* = an arc of (6°—2°), and its measure on a circle of 5 inch radius.

$$= \frac{3{\cdot}1416}{360} \times 10 \times 4$$
$$= \frac{125{\cdot}664}{360}$$
$$= {\cdot}349$$

Therefore, we have (Fig. 38)

$${\cdot}1777 : {\cdot}349 :: P : Q$$

and

$$Q = \frac{{\cdot}349}{{\cdot}1777} \qquad (a)$$
$$= 1{\cdot}964$$

For Fig 39,

$${\cdot}3489 : {\cdot}349 :: P : Q$$

and

$$Q = \frac{{\cdot}349}{3489}$$
$$= 1{\cdot} \qquad (b)$$

And for Fig. 40,

$${\cdot}5373 : {\cdot}349 :: P : Q$$
$$Q = \frac{349}{5373}$$
$$= {\cdot}649 \qquad (c)$$

Then moment about *g* (Fig. 37)

$$= 1{\cdot}964^{(a)} \times 2{\cdot}54 = 4{\cdot}988$$

about *h*, $= 1^{(b)} \times 5 = 5$

and about *k*, $= {\cdot}649^{(c)} \times 7{\cdot}69 = 4{\cdot}99$

This effect will undergo some modification practically, since perfectly smooth planes do not exist, though in well-finished ruby or garnet pallets the co-efficient of friction must be very low: but yet we have no date of any reliable experiments. We can, however, estimate the effect of brass and steel, of which material by far the greatest quantity is composed. We know that the limiting angle of resistance and co-efficient of friction between these metals is 8° and ·142 respectively (see p. 115, Vol. VI.)*

Construct Fig. 38 on a large scale, draw $d^1 p$, and make $d^1 p\,d$ = the limiting angle of resistance = 8°; then, by measurement in ratio to the base, *d p*, $d\,d^1$ will equal ·02487. Let $d^1\,d\,p$ represent a smooth inclined plane, and P applied to $d^1\,p$, then we have

$${\cdot}1777 : {\cdot}02487 : P : Q^1$$

and Q^1

$$= \frac{{\cdot}02487}{{\cdot}1777}$$
$$= {\cdot}14$$

But with an inclined plane of brass and steel, we have equilibrio at 8°, and Q^1 becomes = *o*; therefore, ·14 represents the loss on inclined or impulse planes of the above construction.

Hence we have to deduct Q^1 from Q, and thus obtain

$$Q\ (a) = 1{\cdot}964 - {\cdot}14 = 1{\cdot}829$$
$$Q\ (b) = 1 - {\cdot}14 = {\cdot}86$$
$$Q\ (c) = {\cdot}649 - {\cdot}14 = {\cdot}509$$

Then, under these conditions, moment about *g* (Fig. 37)

$$= 1{\cdot}824 \times 2{\cdot}54 = 4{\cdot}6329$$

about *h* $= {\cdot}86 \times 5 = 4{\cdot}3$

and about *k* $= {\cdot}509 \times 7{\cdot}69 = 3{\cdot}9$

Thus, neglecting friction on the pivot, a circumferencial force of the wheel = 1 will turn a pallet, whose radius is equal to *g c*, with a power of 4·63, one whose radius is *h c*, with a power of 4·3, and one whose radius is *k c*, with a power of 3·9; therefore friction modify the result in favour of the short pallet.

We have yet to show the loss sustained by friction during the motion of the tooth over the whole of the plane, the above giving us the result at a point only.

(To be continued.)

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* There will appear some geometrical error in relation to these triangles (Fig. 37), because arc *p d* is described with a radius which is greater than half *c h*, and therefore the base of the triangle *p d c* must be greater than half the base of triangle *q d c*. This error, however, does not effect the truth of the demonstration. We could have represented the facts to be shown by other methods, but have advisedly chosen this, considering it to be most readily understood.

† Tangent ½ (12° × 4·4) × 5 = nat. number 2·5475
Tangent ½ (12 × 7·5) × 5 = nat. number 5·
Tangent ½ (12 × 9·5) × 5 = nat. number 7·699
but 2·5475 × 2 = 5·0995
and 2·5475 × 3 = 7·7225

Therefore, there is an error between *c g* and ½ *c h* = ½ 5.0995 — 5 = ·0384, and between ½ 7·7225—2·5475 = ·0266, which practically may be neglected.

* We know that the application of oil reduces friction, but we cannot take its effect as a standard, because from the time it is fresh to the time it becomes dry the effect is continually changing.

The Story of a Presentation Watch,
AS TOLD AT THE JAW-MUNDUM CLUB.
By C. Stuart Murray.

"All work and no play, makes Jack a dull boy."

[In these nineteenth century nights one cannot always be slaving in the dreary millhorse round of existence—from work to bed and from bed to work. As all trades have their humorous sides put forward now and then, why should not ours? We love a laugh as well as other folks; therefore, let us have it in our own way. As truth is said to be stranger than fiction, the teller of the "Story of a Presentation Watch" will make good that proverb, and, furthermore, prove that he is no "story-teller." It will be found to contain as much blundering fun as could well have been compressed into the space occupied. There will also be sundry crumbs of philosophy scattered here and there, which the writer of the tale took down from the lips of the tale-teller.—Ed.]

NIGHT THE FIRST.
"An Owre True Tale."

SOME dozen years ago or more the present writer made the acquaintanceship of a very genial, elderly gentleman, whose summers were rapidly rising to the patriarchal number of three-score and ten. He was a man of remarkably varied intelligence, and had seen "all the world and his wife" as much as most men. We usually met in the smoking-room of an hotel—the Jaw-Mundum Club—and there, behind the clouds,—clouds of our own making—we canvassed the political questions of the day, made and unmade governments, and generally got ourselves into the fair way of putting the world and mankind to "rights" just as the waiter called out, "Time's up, gentlemen."

One evening, a conversation arose about a testimonial that was being "got up" for one of our distinguished public men. His services were canvassed and re-canvassed, until, ultimately, the whole subject was surveyed as far as the testimonial horizon extended. As may be readily understood, almost every one had some experience to relate, "from grave to gay, from lively to serene." At length our friend's turn came, when he replied, "Oh, yes; I have been the victim of a testimonial, as well as, I dare say, other people." The *victim!*" was echoed, in exclamations of surprise. "Why, how can a man be the victim of a testimonial? It was not a white elephant, surely?"

"Pretty nearly," was the answer. "However, as the evening is young, if you do not think that the story may be too long, and do not object to it, I will tell you all about it; but not in one night—in fact, I shall want several nights."

"Hear, hear," we all chorused: and, in order to avoid interruptions, the waiter was told to replenish our "empties," which was soon done, and our friend began:—

I was for several years the honorary secretary of a private association of inquiring minds under the title of "The Arachnoid Textile Experimenters." Now as *arachnees* is the Greek for spider, and as textile signifies that which is or may be woven, the nature of our experiments and aims may be readily understood; in fact, we were engaged in the very laudable work of endeavouring to ascertain whether or not spiders' threads could be commercially manufactured into gloves, stockings, and similar light articles of summer wear, especially for ladies. Our name was somewhat taking, partly on account of its learned character, and partly on account of the wonderfully scientific knowledge which we were supposed to have stored up within us. We made many experiments, it is true: but I, as the secretary, am not aware that we ever turned out either a glove or a stocking, although rumour, that knew a great deal more about it than I did, gave it to our neighbours for certain that we had presented Queen Victoria with specimens of both! But that was only another illustration of the old "saw," that there were people far beyond the four walls of our meeting-room who knew a great deal more about what was going on among us inside than we did ourselves. Such is life. For myself, my business was of the usual secretarial character, in keeping accounts, entering minutes, and amusing "distinguished visitors" with civil nothings in the way of small talk when they called. The weaker vessels took great interest in our work; indeed, there was scarcely a day that the postman failed to deliver good-sized letters, containing cobwebs very carefully stretched upon fine, tinted note-paper, and, oh! so divinely scented. Some enthusiastic admirers even went so far as to send to us carefully-packed bottles of old port, so that we might investigate the woven fabrics surrounding the corks. I am free to confess that those were the cobwebs that attracted my attention, and, I believe, that of the society, also, much more than any number from old ceilings or room-corners. I see some gentlemen quietly smiling, which makes me think that my words are being construed in a peculiarly pleasant way to themselves.

But a very important change was getting ready for us, us, and it came suddenly and strongly. Alas! I sigh whilst I think about it, even now.

The cause of the loss to the world of our grand experimental discoveries arose in this wise. Most of our working members were very much married, and, having heard what rumour had said, the wives began to press the husbands about being the first to receive the first stockings and gloves that were made next, now that the Queen had been supplied. This came upon us like a thunderbolt. It was in vain that each husband solemnly assured each wife that no gloves and no stockings had been made at all. It was true that they had got as far as the top of a glove thumb and the unfinished toe of one stocking, but no further. That statement only made matters worse—much worse than if nothing whatever had been said. A native Indian gentleman, Mr. Abdoola Chutneybung, had espoused an English lady from one of the excitable counties, and she, being acquainted with what are called "risings" in the country of her liege lord, headed the rebellion. "Oh, then, you admit, Mr. Chutneybung, having got the thumb-top and the stocking-toe, do you? That quite satisfies me—and, I am sure, must satisfy the other ladies—that the precious specimens are made, but that we are not to have them. Some favoured names are down for them, no doubt. Oh, Abdoolla, Abdoolla!" and the lady began to sob hysterically, whilst Mr. Chutneybung commenced — well, *perspiring*, very loudly. At the next meeting notes were compared, and much the same scene had occurred all round.

After an anxious night of deliberation, and the discussion of some experimental cobwebbed port that had been sent, the melancholy conclusion was arrived at that there was nothing to be done but to "wind up the concern." Of course, the ladies who had brought all this about would be sure to demand the reasons for our unheard of dissolution. Further consultation, and further into the night we went, until at last it was decided, "That, in consequence of the secretary being prohibited by his chief of department from taking part in any speculative experiments, upon pain of dismissal from a valuable appointment, and as he was the only one who could prepare the cobwebs and arrange them for the weaver, the Society must suspend operations for the present." When that was communicated to the ladies, there was weeping, and wailing, and—well, considering that the complete "set" of those of them who had sets cost from ten and fifteen to twenty guineas each, there was not as much "gnashing" as might have been expected under the circumstances. Of course, they all congratulated the Queen on her good fortune—it was no use telling them to the contrary—and lamented their own ill-starred fate. A final meeting was held, at which my attendance was dispensed with, and the outcome of that meeting was, "That, in consideration of the able and valuable services of our respected honorary secretary, a suitable watch be presented to him of his own choosing." The ladies were called upon to contribute, and—my conscience sorely smites me whilst I tell it—poor, deluded woman did contribute most liberally, "hoping that some fortunate chance may enable the secretary to resume his position at an early date!" Little, dear souls, did they imagine that their sad impatience had been the prime mover of the end of our labours!

"Sigh no more, ladies, sigh no more,
Men were deceivers ever."

A supplemental meeting was held to determine what kind of watch I had decided upon, and who was to make it. As there was to be no reasonable stint in price, and as the money was ready, my modesty dictated that I was to do to myself as I would wish others to do unto me, I fixed upon a gold chronograph. In order, too, that there should be no mistake about the "plain" character of it, I wrote every particular out, even to the dial. I was coached up in the method of doing this by a tenth cousin on my mother's side, who was well "up" in horology from being a head porter at a first-class retail house in London. He gave the leading lines for the specification, and I filled them out accordingly. I have a copy of it in my pocket-book, and as there are several watchmakers in the room, they will be able to say, when I have read it, whether my tenth cousin really understood his business as a watchmaker's porter or not. The "article" was to be an 18-size three-quarter plate keyless going-barrel; the movement to be jewelled throughout, either in rubies or sapphires, with a diamond end-stone on the cock-pivot of the balance. It was to have a best compensation-balance, Brequet-sprung (isochronised), and to be adjusted. The chronograph hand was to indicate fifths of seconds, to start, to stop, and to fly back from three distinct pushes of the pendant, and to sound a "ping," as from a repeater stroke upon a bell-wire at each push. The dial was to have a sunk centre for the hour-hand, whilst the chronograph circle was to be marked in fifths of seconds, and to be numbered, commencing at "25" over the hour figure of "I," and so on with a 25 fifths added up to "300" over the "XII." Each fifth second was to have a line-mark double the length of those of the others. These numbers would constitute a beat of 18-thousand an hour in the train, and would be the best for power and resistance to disturbance in the pocket of an actively moving man. If the adjustment produced no greater divergence than a minute a week from Greenwich Mean Time, that would be quite near enough for all the purposes of every-day life, although a minute a month was frequently guaranteed in such instruments. There was, also, to be a winding-square in the event of the keyless action at any time getting out of order, and it was to be well protected against dust, while the stop-work was to be strong, simple, and certain in operation. A safety-pinion was to be screwed on its arbour in such a way that, in the advent of the mainspring breaking, the recoil should unscrew this pinion and so take the jerk off the train, thereby preventing the stripping of wheel teeth. Those who understand watchwork will know that this pinion takes into the great wheel of the train which in going-barrels is on the barrel, whilst to those who do not so understand it does not matter, as an explanation of it without a movement to show it would not be of any service whatever. The cases were to be "snaps," 18-carat, Hall marked, best make, and with crystal bezzle. The bow made to swivel so as to give better protection than usual against the "snapper up of inconsiderable trifles" in the streets. "If you get your watch well made in that style," said my decimal cousin, "I do not think that you will have much cause to complain. Our people would, no doubt, make it, but, as I am head porter to the establishment, it had better, perhaps, be left to the subscribers themselves to choose."

Well, it *was* left to the subscribers, and they *did* choose. With what result you shall hear as I go on.

The evening arrived when a committee assembled to decide upon the instrument and to choose the maker. The "specification" was accepted and the names of several well-known firms were discussed. Some spoke of sending to Geneva, some here, some there, and some to Glashuette near Dresden. Whilst the steam was being blown off in this way, one of the committee said he knew a watchmaker, a first-class man he believed, who would turn out a first-class article at a comparatively moderate price. Everyone gave in to this proposal, and the "first-class" man's estimate was so much below what was expected that a small subscription added—a "whip" all all round—would be sufficient to ensure a presentation supper. The secretary of the committee wrote to the "artist" who had been selected, that he was to be exceedingly careful, as the keenest of keen eyes in the making of best work would examine the watch before it would be many weeks old. He promised to be particular accordingly. After the expiration of several weeks, which the maker said had been occupied in "timing"; that is, getting the best rate possible out of the instrument, he passed it on to the hon. secretary.

The all-important night arrived, and the bustle at the "Lever and Pallets" tavern told plainly that some unusual matter was under weigh. Supper was announced, and we all entered the room and seated ourselves, your humble servant on the immediate right of the chairman. To say that the table "groaned" would be a weak figure of speech, besides being far too hackneyed for our purpose. The diaper-covered mahogany absolutely yelled in agony at the burden which had been laid upon it. This burden extended from cold boiled brisket all the way up to "tripe and inguns," and at a given signal the festivity began. Some of us "tucked" into the good things before us as if we had had several days training in the old Spitalfields breakfast line: namely, a short pipe and a tight apron. My decimal cousin, of course, was there in his best Sunday clothes, and he seemed to be uncommonly hungry. He explained to me afterwards that "he had never been two minutes still, since he got out of bed, and had been obliged to nip short grass all day long in consequence of the pressure of business." Poor fellow! He told me that he had been "run off his legs the whole blessed day," and that that was the reason why his knife and fork had been so busy at the table, with a great deal more in his own particular vernacular, after the fashion which you have just heard. For myself, I was far too much excited to pay any attention to the supper niceties; for, beyond a couple of slices of ham and the leg of a cold turkey, followed by two or three decent servings of tripe and onions, helped along with a tumbler or so of punch, I ate very little indeed. As I have said, I was considerably excited, and when I sat down found that my appetite was completely gone, or very nearly so. However, I managed to get along very well upon the few morsels that I have just mentioned.

The writer must here break the narrative to say that, after the statement about the ham and turkey, the tripe and onions, and the "tumbler or so of punch" upon an appetite "completely gone," there was a fair amount of suppressed tittering round the room. What his appetite completely at home might be was a speculation. However, we had the waiter in, replenished our glasses, and he resumed.

Our chairman was a Mr. Cobb, and, curiously enough, the "vice" was a Mr. Webb. But what was more curious still was, that Mr. Cobb's son was the husband of Mr. Webb's daughter, and that several young Cobb-Webbs were in existence. There was much quiet merriment when this was known round the table; the more especially as the owners of the two names were gentlemen not an ounce under fourteen stone weight each. A promising grandson, a "good thumping lump of a lad of twelve" had by a singular oversight been christened at the font "Cobb-Webb." And, as if still further to intensify the comic element in the matter, Mr. Cobb was "related" in some way to the great brewers of the celebrated Margate ale, whilst Mr. Webb was an extensive manufacturer of elastic materials in Derby. During supper a "distinguished party of ladies were present in the gallery," as the newspapers would say. The ladies being the wives and relatives of the "Society," and the gallery being a portion of the long supper-room, screened off for the nonce, where the said ladies were enjoying their "cut and come again" like the rest of us. The supper being over and the cloth removed, this screen was taken away and the ladies and the gentlemen then became one company—and a brilliant company it was, let me tell you.

The chairman rose and said that as time was getting short the usual Queen and cetera toasts would be taken as having been well proposed, warmly received, and ably responded to, and he would come at once to the great object of the evening. Amid a storm of applause he looked at me, and at that moment, little though I had eaten, I sensibly felt that the few mouthfuls of tripe and onions, and turkey and ham that I had taken were disagreeing with each other in the regions below. During this pleasant by-play the horological artist placed the instrument that was to be mine in a few minutes on the table in a fine Morocco case lined with blue silk, and "anchored" to a massive-looking Albert guard. The guard somewhat astonished me, as I had heard nothing about it before; but the chairman nudged me and said that "It'll be all right." He then entered into the whole history of the affair, very prudently suppressing the causes of our dissolution, for were not those causes present in the flesh, "got up regardless of expense" for the occasion; and, no doubt, their voices were equal to any demands that could possibly be made upon them had the real truth come out. But "the practical difficulties that always attended purely scientific investigations" was the chairman's sheet anchor. He rode safely through the evening with it, the above expression having secured the clapping of hands of the ladies. He next dilated upon the great merits of the guest of the evening; and with such warmth that I began to feel as if my merino undershirt was "in the wash." In fact, I never had the slightest idea before that I was half such an able fellow, and I began to see plainly that there was an ambitious career open to me "somewheres," if I could only find out where the "wheres" were. The chairman was followed by "the worthy vice," and he, again, by Mr. Abdoola Chutneybung. Then he read an elaborate inscription engraved on the dome, and, amidst a storm of cheering, clapping of hands, and waving of cambrics from the bright end of the room, the glittering gift was presented to me. In handing it over the chairman produced much laughter by remarking that he knew that I was pretty well up to the time of day; but in this age that was not everything; it was necessary to know what that time was. Time was money, and the splendid instrument that was now in our respected friend's hands would show him—if anything could show anybody—what the value of money was. Alas, little did he know how prophetically he was speaking! I rose to thank them, beginning with an "original" sentence:—"Unaccustomed as I am to public speaking." Here the lights grew dim—some of them double—and I could not tell anyone any more that I said. I was brought to my senses by being complimented on the very excellent speech that I had made!!! More toasts and speeches followed, the "vice" giving "The Ladies." To our great wonderment, as we stared at her with open mouth, Mrs. Abdoolla Chutneybung responded, and with a mischievous twinkle in her eyes hoped that her majesty the Queen would enjoy the only practical outcome of our scientific investigations, glove-thumb and stocking-toe included. Her loving spouse laughed immensely. Having looked at my watch and passed it round, something ominous caught my eye. This was, that two leading watch examiners in the trade turned it over and over between them and the light, applied their glasses to it, squinted at each other from the corners of their eyes and—*touched elbows*. After that they gave a smiling bow and passed the instrument on. How that did haunt me to be sure! As it was now half-past eleven o'clock, and as there was a considerable buzzing of the ladies around Mrs. Abdoolla C., we thought that things began to look "suspicious" for another speech from that quarter; the chairman took the hint and wound up hastily with, "To our next merry meeting," and we all departed.

(*To be continued.*)

The Discrimination and Artistic Use of Precious Stones.*

By Professor A. H. Church, F.C.S.

(*Concluded from page* 34.)

I WISH I had time to say something about the amethyst, both the violet quartz and the harder and infinitely rarer violet sapphire. But if I have been compelled to omit such observations, and many other things which I would gladly have included, I may, perhaps, entertain a reasonable hope that what I have found time and opportunity to introduce may stimulate the production, and the appreciation also, of new and choice colour-combinations of precious stones, and may tend to a more lively and intelligent interest in those little-known and little-prized species, the jargoon, the tourmaline, and the spinel.

Before concluding, I may be permitted to direct your attention to two matters of considerable importance in connection with this subject, if our interest is to be sustained, enlarged, and educated. I refer to collections of specimens of precious stones, and to books on the subject. You must go to public museums if you are to see a jargoon or a tourmaline. With a very few exceptions, the largest and most noted London jewellers could not produce a single fine specimen of these curious stones, nor identify them if they were shown to them. I had five good stones mounted by a well-known goldsmith a few years ago, and he misnamed every one of them in the bill. Signor Giuliano, of 115, Piccadilly, is, indeed, the only artist-jeweller whom I know to have made a speciality of the judicious employment of these out-of-way stones.

I commend to your notice three collections of precious stones. In the Museum of Practical Geology, Jermyn-street, there is a small series amongst which the jargoons (especially a green one) are particularly fine. In the Mineral Department of the British Museum, now at South Kensington, a most complete series of every kind of precious stone, distributed, however, in many cases according to their mineralogical position, will be found. And the South Kensington Museum itself owns a fine series of mounted precious stones, 178 in number, the bequest of the late Rev. Chauncey Hare Townshend. Unfortunately the official catalogue (1877) of the Townshend collection contains more than twenty incorrect or doubtful attributions. But you will learn much from this series, if you will bear in mind the corrections which I made in this list, in a paper published in the *Spectator*, on July 9th, 1870, which I repeated in the *Quarterly Journal of Science* for January, 1871, and which were adopted by Mr. Hodder M. Westropp, in his compilation, published in 1874, and entitled a "Manual of Precious Stones." I will just give you a single instance of how misleading are the names affixed to some of the Townshend gems. On page 17 of the catalogue (last edition), Nos. 1306 and 1307, and those only, are described as hyacinths, jacinths, or zircons. Both are garnets, and so the Townshend collection would appear to include no representative of this interesting species. But this is not so. For Nos. 1281 and 1282, called garnets, are really zircons: so, probably, is No. 1305, which figures as a chrysolite: and there is a fourth characteristic specimen, No. 1322, labelled tourmaline. But if you make these corrections and 14 others (Nos. 1184, 1188, 1192, 1194, 1195, 1277, 1290, 1297, 1298, 1299, 1304, 1309, 1312, and 1318), you may study the remainder of these specimens with satisfaction and confidence. In a neighbouring case to the Townshend series there are some interesting specimens lent by the Right Hon. A. J. Beresford Hope. But here note that Nos. 60 and 61 are not jacinths, but garnets: that 42 is not a sapphire, but a bit of blue glass worth 4d. or 6d.; that 53 is not an emerald, but a bit of green glass, though next to it is a veritable emerald, or rather two, carved into a vinaigrette; that No. 110, called an aquamarine, is actually a sapphire, and that No. 113 is a tourmaline, not an aquamarine.

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* A Lecture, delivered at the Society of Arts.

Of the many books written of late about precious stones, few have any claim to scientific exactness, or afford any satisfactory indication as to the artistic arrangement and use of precious stones. Many interesting facts and fancies about particular stones, and about their commercial aspects, are given in Mr. H. Emanuel's "Diamonds and Precious Stones" (1865); and more particularly in Mr. E. W. Streeter's "Precious Stones and Gems" (1877). But the little volume by M. Louis Dieulafait, entitled "Diamants et Pierres Précieuses" (1871), which has been translated into English, commends itself on many accounts as the neatest, cheapest, and most trustworthy manual of the subject which has yet appeared. I venture to refer also to my own papers previously named, to one in Vol. I. of the *Magazine of Art*, and to a paper in the *Proceedings of the Geologists' Association*, Vol. V. No. 7.

In conclusion, I must ask you to pardon the omissions, and they are many, in this paper, in which a large subject had to be handled in a short time. And I must ask you, further, to pardon the imperfect and inadequate manner in which I have attempted to express the results of my own thought and work, in those sections of the subject upon which I have found time to say something. If my paper serves in any way to stimulate and direct thought upon the artistic employment of precious stones, such a result will be as much as I could have hoped for, and more than I have warrant for expecting.

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Practical Instructions to Jewellers, Silversmiths, and Electroplaters.

By A. Roseleur.

(Specially Translated and Revised for this Journal.)

Continued from page 26.

No. XXVIII.

Separating Gold from Gilt Articles.—Iron and steel articles are ungilt, without any injury to themselves, by dipping them into a bath of 10 parts of cyanide of potassium and 100 parts of water, and connecting them with the positive pole of a battery. A wire or foil of platinum is fixed to the negative pole. This is inverting the position of the poles, and in this case the gold applied upon the iron or steel is dissolved in the solution of cyanide, and partly deposited upon the platinum anode, from which it is removed in a regular gold bath. When there is only a film of gold upon iron or steel, it may be removed by the cyanide alone without the aid of electricity, but the method is slow. Silver, copper, and their alloys, may also be ungilt by this process; but the cyanide dissolves, at the same time, the gold and part of the other metals;. is therefore preferable to operate as follows:—For ungilding silver, it is heated to a cherry-red heat and immediately thrown into a pickle of more or less diluted sulphuric acid. The gold scales off and falls to the bottom in the shape of spangles. The operation is repeated until gold no longer appears upon the surface of the silver, which is then white and frosty. This process is not adapted to light and hollow articles, for which the preceding process is better. For copper and its alloys, in small articles, such as false jewellery thinly gilt, either by battery or by dipping, use the following bath:—

Sulphuric acid	10 parts.
Nitric acid	1 ,,
Hydrochloric acid	2 ,,

The large quantity of sulphuric acid allows of the solution of gold, whilst it does not sensibly attack copper or its alloys. The sulphuric acid is put alone into a stoneware jar, and the mixture of hydrochloric and nitric acids, kept in a stoppered bottle, is gradually added to it as the operation proceeds. The same sulphuric acid may last a long time if it is kept well covered, and its dissolving action promoted by successive additions of nitric and hydrochloric acids. The articles should be often withdrawn to watch the operation, which is terminated when no gold is seen, and when the copper has acquired a uniform blackish-grey coat; or, by plunging the objects into the compound acids, they will be perfectly cleansed when the gold has all dissolved.

Saltpetre and common salt may be substituted for nitric acid and hydrochloric acid; the salts must be finely powdered and stirred with a glass rod.

For large objects, such as clocks or chandeliers, concentrated sulphuric acid, 66° Baumé, is put into a glass or stoneware vessel supporting two brass rods. One of these rods is connected by a conducting wire with the last carbon of a battery of two or three Bunsen's inverted elements, and supports the objects to be ungilt, which are entirely covered by the sulphuric acid. The other rod supports a copper plate facing the object, and is connected with the last zinc of the battery. The electric fluid traverses the sulphuric acid, and carries the gold from the positive to the negative pole; as the copper plate is not prepared for retaining the gold, it falls to the bottom of the bath in a black powder, which is easily recovered. So long as the sulphuric acid is concentrated, and even under the action of the galvanic current, it does not sensibly corrode the copper, and as it rapidly absorbs the dampness of the atmosphere. The vessel in which it is contained should be kept perfectly closed when the ungilding process is not in active operaration, and the pieces for ungilding should be put in perfectly dry. If it is intended to sacrifice the gilt articles of copper or silver, let them remain in pure nitric acid, which dissolves all the metals except gold, which either floats at the surface of the liquid as a metallic foil, or falls to the bottom as a blackish powder. If the liquor is diluted with distilled water and filtered, all the gold will remain in the filter, and the solution will contain the other metals.

(To be Continued).

Trade Notes.

An improved method of ornamenting the surface of jewellery, &c., has been presented by Mr. Willis H. Howes, of New York City. The object of this is to facilitate and cheapen the ornamentation of buttons and other articles of jewellery. It consists in coating the surface of the article to be ornamented with borax and water or other flux, applying a layer of suitable solder filings, a layer of filings of gold or other metal, and another layer of solder filings, and heating the article sufficiently to melt the solder and fasten the gold filings in place.

* * *

Mr. W. Frishmuth, of Philadelphia, Pa., has patented a process for coating cast iron, or sheets of wrought or cast iron, or other metals with pure lead, or with zinc or tin, in such a manner that the metal coated will be protected against oxidation, and its durability and tenacity preserved; and in such manner that there will be no formation of dross in the molten baths. The invention consists essentially in protecting or preparing the surfaces to be coated by depositing upon them, by electroplating or otherwise, a thin coating of nickel, or an alloy of nickel and aluminum.

* * *

Mr. A. M. Sullivan asked the Secretary of State for the Home Department whether he was aware that, although many of the principal jewellers and silversmiths had complied with the provisions of the Weights and Measures Act, 1878, whereby the adoption of a decimal system of weights, with the ounce troy and grain as basis, was made compulsory on jewellers and silversmiths, no effort had been made to enforce that provision generally, and whether he would direct measures to be taken either to repeal the section or compel its uniform observance. Mr. Chamberlain, replying for the Home Secretary, said the adoption of the troy system of weights for certain articles was made permissive, not compulsory, by the 20th section of the Act referred to in the question of the hon. and learned member. He had no power to enforce the uniform adoption of the principle, nor did he think it desirable.

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The receipts of the Patent Office for the year 1880-81, including stamps, have been £191,529.

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The French Chamber of Deputies finished its session with an act authorising the sale of the Crown jewels.

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Messrs. Harrison & Co., of Sheffield, have opened a Continental agency at Hamburgh for the sale of their electroplated and Britannia metal goods.

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A gold medal and a special diploma was awarded at the Melbourne Exhibition to the Science and Art Department, South Kensington Museum, for its exhibits of electrotype reproductions of Royal plate. These exhibits are *fac-simile* of part of the regalia preserved in the Tower of London.

* * *

We were pleased to learn that Messrs. Singer & Son, of Frome, exhibited at Melbourne, and, as we expected, obtained the highest honours. The *repousse* work of this firm is of the highest merit. Mr. W. H. Singer, although a young man, is already an art metal worker of high standing, and a successful competitor for the prizes annually offered by the Goldsmiths' Company. He also obtained the £100 prize offered by Mr. Watherston for the best essay on the silver trade, and holds the Medal of the Society of Arts. It is to him, also, that we are indebted for the excellent lecture recently delivered at the Society of Arts, and the instructive contributions to this Journal on "Art Work in the Precious Metals."

* * *

Messrs. Phillips, of Charing Cross, have an order for a splendid gold watch for presentation to Major Wingfield, the introducer of lawn tennis, this being the form he has elected his testimonial should assume. The back of the watch is ornamented by an appropriate design, representing two tennis bats crossing each other, with tennis balls at the angles. The whole is executed in relief in silver on the gold case.

* * *

Mr. William Henry Christie, F.R.S., it is stated, has been appointed to succeed Sir G. B. Airy as Astronomer Royal at the Greenwich Observatory.

* * *

We have before us the Statutes of the Watch Manufacturers' Association of Bienne. The immediate result of the Society is the establishment of a special market for the transaction of business, held every Tuesday at the Bielerhof (Hotel de Bienne). Its further objects are the protection and furtherance of the interests of the Swiss watch trade, and the regulation of trade usages. Only manufacturers of respectability are admitted, and the commission of any dishonest transaction will lead to expulsion. Disputes between members are settled by arbitration. Foreign buyers can have free access by signing their names in the visitors' book.

* * *

Saunier's Treatise on Modern Horology, which has already received distinctions at many exhibitions, has taken further honours at Melbourne.

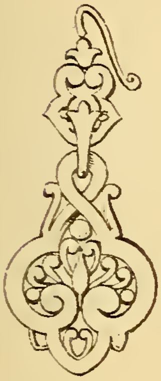
* * *

We read that patriotism of a most substantial kind has been displayed by the ladies of Peru, by their contribution of a considerable portion of their personal jewellery towards the expenses of the war against Chili. Judging from a recent sale which took place in this country of old gold and silver Peruvian ornaments, the voluntary sacrifice must have been great, a single day's sale realising 10,000 odd pounds. Among the articles enumerated in the list of this historically interesting sale are numbered an antique chased gold monstrance, enriched with a multitude of precious stones, which alone fetched £2,000; another monstrance of the same material, set with diamonds and topazes, brought in nearly £1,000; while a fine old cluster of brilliants was found to be valued at £111; an antique brilliant ring, £175; a pair of antique pearl and diamond earings, £235; a pelican of the wilderness, life-size, wrought in solid silver and decorated with precious stones, £380.

Hirst's Patent Jet Mosaics.

We have received from Mr. Godfrey Hirst, of 42, Baxtergate, Whitby, a number of "Jet Mosaics," and we have much pleasure in calling the attention of the trade to these goods, as they deserve and will certainly meet with extensive patronage. The object of the inventor was to produce ornaments suitable for half-mourning and for general wear, in preference to ordinary jet; and by inserting a substance of any desired colour, relieved again by artistic designs in jet, he has produced an article of great elegance. This method of ornamentation enlivens the sombre aspect of ordinary jet, without injuring the quiet tone which makes jet jewellery so dear to those who like ornament without conspicuous display. The coloured matter is *laid into*, not on, the jet by heat pressure, and cannot be removed without destroying the jet itself. It will not fade on exposure to light. Any colours or shades can be obtained, and the matter may be either translucent or opaque. Mr. Hirst also manufactures plaques to be let into cabinet work, &c., and the effect is most successful. Specimens of brooches, bracelets, &c., can be viewed at the office of this journal.

MONTHLY SUPPLEMENT OF DESIGNS.



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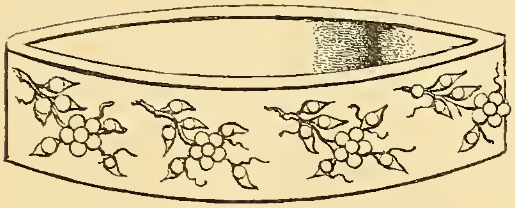

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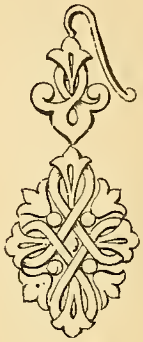

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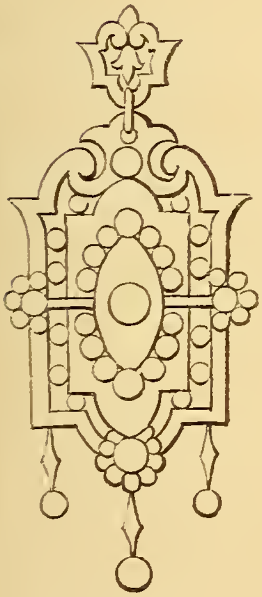

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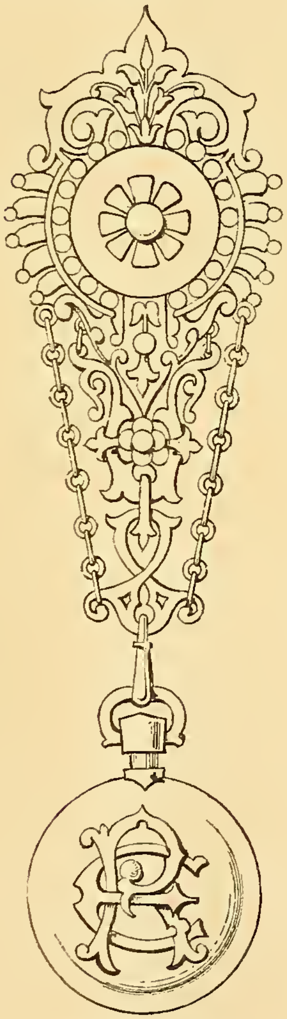

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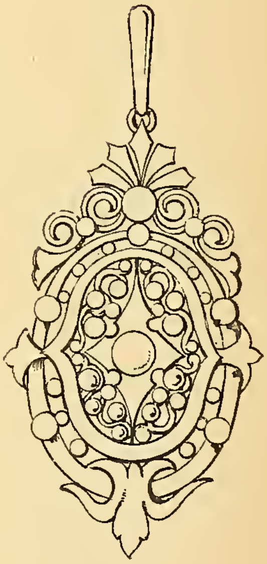

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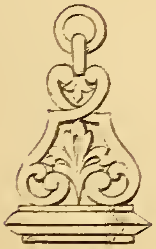

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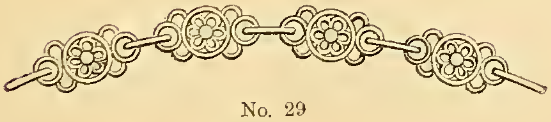

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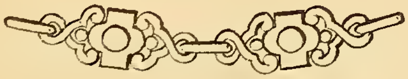

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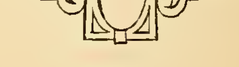

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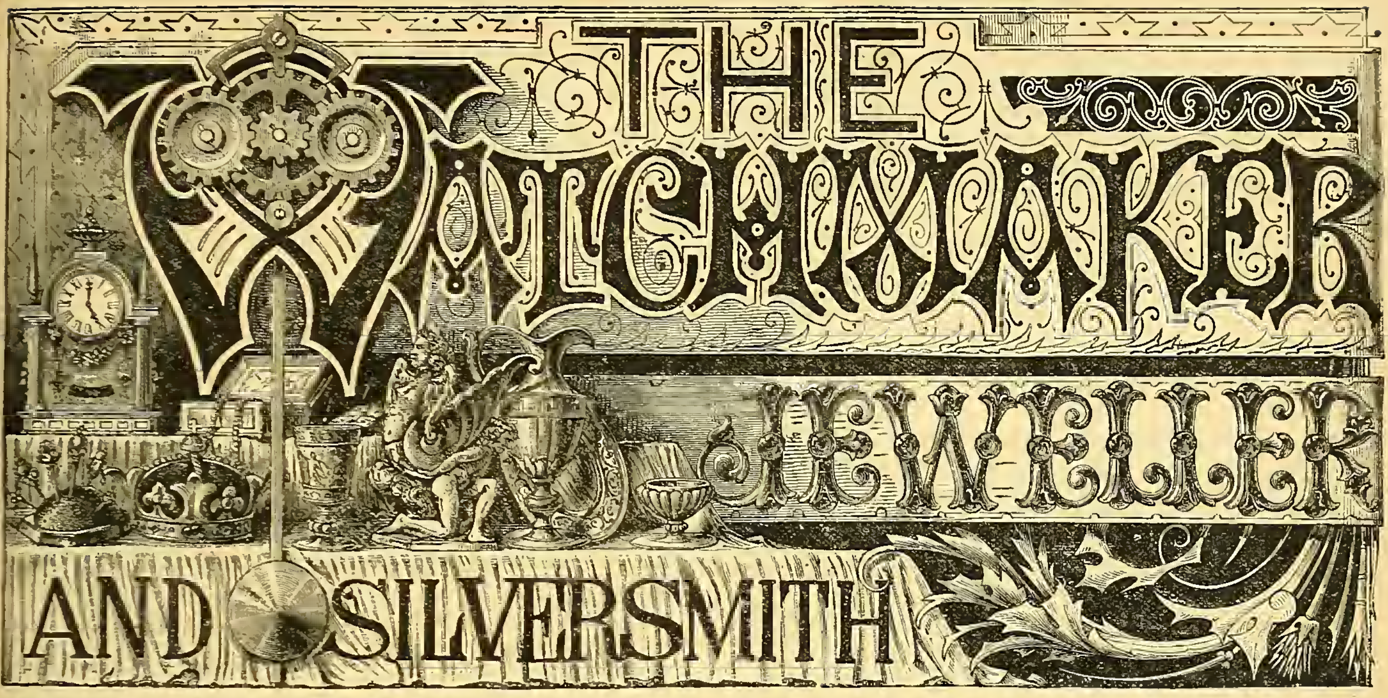

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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No. 77.—Vol. VII.] OCTOBER 5, 1881. [Subscription, 5s. per Annum. Post Free.

English Keyless Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—A sentence in the amusing paper published in your last issue, under the title of "The Story of a Presentation Watch," has reminded me of a point I intended to touch upon, viz., the utility of a winding square to a going barrel arbor, which I think is very doubtful, although it is sometimes allowed to remain, because it gives the watch the appearance of being constructed on the fusee principle. As a matter of fact, if the winding work fails the watch cannot be wound at all, on account of the wheels being in gear, and should there be any broken teeth in the barrel winding wheel, the click-work becomes useless, and the removal of the intermediate wheel would not remedy matters. It is a slight convenience to the adjuster to be independent of the case in winding up the watch, but this end may be attained by having short squares, which do not come through the dome. I would define a going barrel keyless watch as a watch which is made up on a certain principle in order to secure cheapness and simplicity in the winding mechanism; whereas, a fusee keyless is a perfect watch in itself, with the keyless work added as a subsidiary attachment.

The first contrivance which came under my own notice for winding up a fusee watch was termed the "pick up winder"; small circular pieces were fixed on the top plate round the fusee and centre holes, containing hinges, which were screwed on the squares and revolved with them. The circular pieces were let through the dome, and the hinges were raised with the nail for the purposes of winding or setting.

This, at the best, can only be regarded as a clumsy contrivance, and it involved a great deal of "fingering" on the dome; but I mention it to save trouble to some future "inventor."

I will also now refer to an arrangement for winding up a marine chronometer, which was shown me last year at Leith by the patentee, Mr. Matheson. The chief idea is to obviate the necessity of reversing the chronometer to wind it, and also to diminish the risk of damp being conveyed to the balance spring; and the inventor claims to be able to adapt the mechanism to existing instruments.

In the first place, a large wheel is attached to the fusee by means of a long pipe which fits on the square. The teeth of this wheel project over the edge of the brass box, the rim of which is turned through in order to allow the wheel to lie close to the wind-hole. This is brought into connection with the winding-up apparatus by the following contrivance. The key is still retained on the bracket in the corner of the box, and the pipe is lengthened in order to allow another wheel, cut to correspond with the one on the fusee, being fixed on the end sufficiently low to be clear of the fusee wheel when the chronometer is swinging in the gymbals. During winding, this second wheel is drawn up level with the first, and kept in that position by a slide on the top of the bracket being placed in a groove in the pipe of the key, the chronometer itself being first screwed up in the gymbals. The winding being completed, the slide is withdrawn, and the wheel at the end of the key drops down out of gear with the other. It will thus be seen that the existing appliances are utilised in a very ingenious manner, but it remains to be proved whether the advantages will be fully appreciated by captains.

I have referred to the above details at length, because they serve to illustrate the points which have to be considered in a fusee keyless watch, the winding work of which has to be automatically taken in and out of gear, and many of the contrivances to accomplish this end have been signal failures. About fourteen years ago, Messrs. Barraud and Lunds endeavoured to meet the requirements of the public half way, by the introduction of their "patent attached winder," which I will describe. The watch resembled a keyless one externally, on account of there being a button on the pendant; but with this point the resemblance ended. The fusee and set arbors had sunk squares instead of the usual kind, and the end of the shaft to which the button was attached was squared down to fit into these sockets; so the button and winder constituted an ordinary key, which was removed from the pendant before winding, by opening the bottom of the case, thereby releasing a spring which rested in a notch in the winder and prevented it from falling out. The only comment which I desire to make on this plan is, that it does not obviate the risk of a circular motion being given to the watch in winding, the absence of which is considered to be one of the chief advantages in a keyless watch, more especially in a chronometer. While on this point, I would say that the public should be instructed not to wind with any motion of the wrist, but simply by the action of the ball of the thumb over the fore-finger.

To return, however, to the keyless fusee watch proper, the first mechanism which I became acquainted with was on what is termed the "friction band" principle, and I believe I am right in attributing it to Mr. E. D. Johnson, who has spent a great part of his life in planning out ingenious horological contrivances of various descriptions, the majority of which, however, are now displaced by foreign productions. I shall always regard Mr. E. D. Johnson as a representative British Horologist, and it is to be regretted that a business which so severely taxes the health and energies of those who attain eminence in it, should be subjected to the unfair competition which has brought it to its present depressed condition. This digression, however, demands an apology, and I offer one, but not with much doubt of its acceptance. The "friction band" consisted of a circular piece of steel cut open like an index, which was snapped in to an undercut groove in the bevelled wheel. A pin was tapped in, opposite the notch, which came through a hole in the rocking bar. When the bevelled wheel was turned by the winding pinion, the resistance of the friction band threw the end of the bar, and, of course, the wheel attached to it, into the fusee wheel. A spring at the end, just weaker than the power of the friction band kept the bar back when the keyless work was not being used. The set hands spring, which kept back a cock which restrained the other end of the bar, was much stronger than the friction band, therefore there was no throwing in when the button was turned in the contrary direction to winding.

In setting the hands the bevelled wheel moved round the band in either direction, and the resistance of the latter was often unpleasantly felt; in order to obviate this, it was sometimes left too weak for safety, and the intermediate winding wheel, not being effectually thrown in, would sometimes miss the teeth on the fusee wheel. These windings wound to the left, and the hunters had the seconds at the IX, an arrangement which, although very generally adopted, seems to me not equal to the old-fashioned way of having them at the VI.

It should be understood that the position of the frame in the case, to a non-keyless watch is different in a hunter than to an open face, the fusee being to the left of the pendant in the former and to the right in the latter, so that unless the frames to the hunters are put into the cases in the same manner as to an open face, viz., with the seconds opposite the pendant, an entirely different arrangement of the keyless wheels is required.

For a hunting watch, with seconds at VI, and winding to the right, either two wheels, or four, must be employed in winding. The "friction band" winding just described had three wheels, therefore it wound to the left. Another application of the friction principle consisted in a long spring, which laid across the pillar plate and pressed against a circular piece of steel, which moved freely under the fusee winding wheel, both being kept on the arbor by a screw ratchet. The fusee wheel contained a click, which was kept out of the ratchet by a spring, and there was a duplicate click underneath, which lay in a hole on the outside of the first-named circular piece of steel. The bevelled wheel geared into the fusee wheel, and the watch (a hunter with seconds at VI) wound to the right. On the wheels being turned, the pressure of the friction spring prevented the circular piece of steel from turning freely, and overcame the spring, which kept the click out of the centre ratchet; consequently, it was forced into the teeth, and the entire apparatus became a solid piece, dragging past the friction spring during the operation of winding.

In setting the hands, a slide travelled up the end of the friction spring, lifting it on one side, so that the fusee wheel turned freely, and without interfering with the motion of the hands either way; neither was the dragging of the friction band felt in setting. This plan was exceedingly ingenious, but the click and ratchet arrangement was very liable to get out of order.

Another plan consisted of a rocking bar, which was sunk in the plate, under the bevelled wheel [and to which I strongly object for that reason]. Those I have seen were hunters, with four winding wheels. The set hands wheel on one side of the bar was in contact with a fixed stud: on being turned, the effort to release itself threw the other end of the bar forward, bringing the second wheel in contact with the third wheel, geared into the one on the fusee. In setting hands, the first wheel was carried away from the fixed stud or friction piece, and moved freely either way. All the preceding plans could be applied to existing movements, but there is one well-known plan which requires a specially constructed movement.

I would like here to say, that in April last I attended a lecture on the Reform of the Patent laws, at the office of the National Chamber of Trade. It had already been delivered at the Horological Institute, under the auspices of Mr. E. J. Watherston, and, at his invitation, I had the privilege of hearing it again.

In the course of the discussion which followed, I demurred to the opinion that cheap patents would be an advantage in the watch trade, having the many variations of keyless windings in my mind; in point of fact, there is one principle running through them all, viz., a throwing in force to wind, and a detaining force when the winding is completed. The effect of a patent is to confine a workman to one method, and prevent improvements being made by others; besides this, the demand for best watches is so limited, and the sale so slow, that by the time an inventor can make up his mind if the idea is worth patenting, the secret has become known to others. In some cases, "Royal Letters Patent" are taken out by tradesmen in order to form the basis of an effective advertisement; but in the watch trade, it is seldom that a practical manufacturer derives any benefit from this outlay, because he cannot command a sufficient trade to recoup himself. On the other hand, if the cost were greatly reduced, numbers of patents would be taken out for hair-splitting improvements, and if the holders were of a litigious disposition, the money saved at the Patent Office on patents connected with keyless mechanism, would most probably be spent at the Law Courts.

I hope to resume next month.

Yours obediently,
JAMES. U. POOLE.

33, Spencer Street,
Clerkenwell, E.C.

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Machine Work versus Hand Work.

A Reply to Mr. James U. Poole.

(*Continued from p. 41.*)

X.

MR. POOLE, in the October (1880) number of this Journal, page 41, writes: "The neophite will have the pride of using a ferrule of his own make." Well do I recollect the exalted pleasure to which he refers, and do I not speak the experience of a large majority of the readers of this Journal, when I frankly tell you my boyish pride was not a little flattered by the performance of the first verge I applied to a watch: every vibration of the balance seemed to rebound with joy. Little did I think I should live to see it become obsolete, nor did I dream that the exquisite pleasures connected with its manipulation would have to give place to pleasures far greater. Mr. Poole is careful to notice even the smallest advantage connected with hand tools; he is equally careful to avoid noticing any corresponding advantage in machine tools. I will endeavour to supply what he has omitted. His "neophite" will require further regeneration before he will be much good to the world.

The quickest and best way to make a fair estimate of the relative pleasures derived from the use of machine tools and hand tools, is to go to your bench and with hand tools do a hard-day's work. Then go to a machine shop and produce similar work by machinery. Take both into the market, and you will get ten times more for the machine work than the hand work. But do not regard this as the only, or chief, advantage; for with the large return there are no weary limbs, no aching eyes, no anxiety for daily bread, no shattered nerves, which bring premature age, and blindness, depriving us of the laudable pleasures of life. The wearisome monotony of hand work, which bows down our intelligent workmen in slavish chains, will soon be a thing of the past, and they will find themselves released from drudgery for labour far more congenial. The operator of a machine sits while she sings of happy days, perhaps not thinking, or even knowing, what is being accomplished, for it acts with a degree of precision and rapidity unattained by hand tools: the whole system is as benevolent as the work is beautiful.

Nor is the worker alone considered. They have special advantages to offer employers as well as employés: to wit, machine tools are never absent from business, they never get drunk, they are content with their wages, they escape the ills that flesh is heir to, by them no "evils are wrought by want of thought, as well as want of heart," and last of all, and best of all, they come between the distracted manufacturer and the distressed worker, who can no longer compete with the market, and offer them a solution of more than half their difficulties.

A shrewd observer* of passing events once said: "A hundred years hence, our children's children will say what heathens our forefathers were," and, in the unreasonable opposition that is now being made to improved systems of manufacture, do I exceed the limits of charity when I say there is much practical heathenism.

Let a mechanic go through such a factory as Sir Joseph Whitworth's, of Manchester, and see a planing machine carrying a load of fifty tons, and ploughing up the metal as easily as you can plough up the sand on the sea shore; and in the same factory witness a grinding machine reducing a gauge at the rate of one hundred thousandth part of an inch per stroke, and he will have a dull soul if he does not experience a pleasure that he cannot express.

These things appeal not only to our sense of business propriety, but also to our philanthropy, and I am sorry to think they have been so much neglected in English watchmaking, that it is now compatible with the dignity of some Clerkenwell *watch manufacturers*, who, when an emergency arises in business, have to ask a workman as to whether compensation balance-screws can be ultimately made by machinery. If they cannot confide in their judgment respecting the making of a compensation balance screw, how can they expect others to accept their decision about "making the screw, and the tapping the hole to a chronometer detent."

We now enter upon the "serious business" of making rollers, balance stafts, levers, &c. By the side of the hand work Mr. Poole describes, together with the system of manufacture Mr. Curzon teaches, I intend placing the machine-tool process of manufacture, leaving it for those interested to judge which is best.

I regret to inform the reader that I am no longer allowed to visit the class at the Institute, Mr. Glasgow having authorised Mr. Curzon not to admit me in future. I intend to appeal against this decision, which will occasion some little delay, and prevent me continuing my reply to Mr. Poole next month. In the interval, I will write A Short Essay on the Construction and Manufacture of Low-priced, and Adjusted, Key, and Keyless Going-barrel Watches, with Models of Watches suitable to the requirements of the Market.

RICHARD WHITTAKER.

(*To be Continued.*)

Erratum.—On page 41, third line, instead of "*Institute*" read "*Opposition*."

I have to apologise for my inadvertence in mentioning "*David Copperfield*," instead of "*Oliver Twist*," as a type of parish training.

◆

Novel Spoons and Forks.

Under the name *Siderophron* (heart of iron), Mr. Alfred Browett, electro-plate manufacturer, of 14, Dean Street, Birmingham, has introduced a new line of spoons and forks, which will, no doubt, largely supersede the common plated brass goods, being a much superior article at the same price. Siderophron spoons and forks have, as their name indicates, a heart of iron—that is, they are formed of tempered steel blanks, which are thickly cased with molten Britannia metal, and finally electro silver-plated. Great strength and lightness are thus attained, while they have all the lustre, finish, and ring of sterling silver. A further advantage is, that they wear always white as long as they are in existence, and their chief constituent, Britannia metal, being anti-corrosive, and one of the most harmless of metals, they never become injurious, even when used with acids. They are made in the usual antique, fiddle, and old-English threaded and beaded patterns. We can say, without hesitation, that they are the nicest goods we have ever seen at such a price.

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* Richard Whately, the late Archbishop of Dublin.

Practical Instructions to Jewellers, Silversmiths, and Electroplaters.

By A. Roseleur.

(Specially Translated and Revised for this Journal.)

(Continued from page 51.)

SILVERING.

Plated Silver.—This is obtained by rolling together a plate of copper of the first quality, and one of silver; these are either welded, or simply united by placing their hot and clean surfaces together, wetted with a concentrated solution of nitrate of silver. The two metals are reduced and drawn out about equally by the pressure of rolls, and long sheets or bands of silvered metal are thus obtained, with which a great many articles may be manufactured. By this mode of operation a great quantity of material is lost, as the objects have to be cut out from a sheet entirely silvered, and the waste retains a large proportion of that metal: the cut sections present parts without silver, which must be hidden by ledges, or by silvering by another method. There is also the absolute necessity of employing pure copper, which is more costly, less sonorous, and not so tough as its alloys; but the greatest defect of the process is the difference of thickness of the silver, according to the shape of the object. Raised surfaces are the most exposed to friction, and it is just there that the coat of silver is the thinnest; the conditions are reversed with electro-silvering, and the parts in relief receive a more abundant deposit of silver, which is a satisfactory result. The best plated silver is manufactured by applying upon an ingot of pure copper weighing 9 parts another ingot of pure silver weighing 1 part, to coat one side only; add another coat of silver if it is intended to coat both sides. The two are rolled together until the desired thickness is obtained. The silver of the plated metal will be bright if the rollers are well polished, and dull with rough rollers. The only solder which does not injure plated silver is tin solder; and when the objects manufactured are required to resist a warm temperature, nuts and screws are employed.

The electro-plating of old wares made from copper with a covering of silver, is often difficult. Supposing it is required to electro-plate an old cruet-stand, the bottom is separated from the wire, either by unsoldering or unscrewing. Smooth by emery cloth or pumice-stone and water, or by powdered bath-brick brushed over with a hard brush. Spots of verdigris are removed with a few drops of hydrocloric acid. The great difficulty consists in giving a good electro-deposit upon the edges or mounts where there may be some lead or lead solder; apply to such parts, with a rather soft brush, a solution made by dissolving 4oz. of mercury in nitric acid and adding about half-a-pint of cold water. This solution is lightly brushed over the lead mounts only; the article and brush are then to be well rinsed, and the brush and plain water applied in the same way. The solution of mercury will turn the edges black, or dark grey, but the subsequent brushing will render them bright again. The frame, when well rinsed, is ready for the depositing bath. If, on its first immersion, any blackspots appear, the frame may be removed, again brushed over, and finally returned to the bath; if the edges do not receive the coating of silver as readily as the other parts, the solution may require a little more cyanide, or a greater battery power, or an increase in the surface of the anode. These lead edges may be prepared for receiving the silver deposit by a previous coat of copper applied as follows:—

The edges are plunged into a solution of sulphate of copper, with a little free sulphuric acid in it; then, by touching the lead edge with an iron wire, it is immediately coated with a bright deposit of copper, which is rinsed and becomes a good conductor for the further electro-deposit of silver. The coating of tin underneath the bottom of cruet frames is very difficult to plate, unless in a solution made expressly for it; therefore, it is preferable to remove it either with abrading materials, or with nitric acid employed with care. This process of depositing copper will be found useful not only for old plated ware, but also for many articles on which are found unruly spots of tin solder.

Silvering with Silver Foil.—This method is never practised except upon objects already manufactured in their definite shape; and is adapted to all kinds of copper, bronze, or brass. It is, in certain respects, superior to plated silver, but is very difficult of execution, and has less adhesion to the metal underneath. After annealing the articles, they are thrown, whilst hot, into a bath of sulphuric acid, with a small proportion of hydrochloric and nitric acids. They have, then, a dull and dead lustre, owing to a multitude of small holes, which are so many points of attachment for the silver foil. The objects thus prepared are lightly fixed upon an iron rod which is held in a vice. Their temperature is raised to about 300° F., by means of incandescent charcoal put at the proper place, so as to open the pores of the metal, which, by cooling afterwards, will imprison the silver applied. The silver foils, taken from the book with small tweezers, are cut to the proper size upon a cushion with an ivory or steel knife. After each foil is deposited upon the object, it is made to adhere by a light pressure of a rag pad, and afterwards by the friction of a steel burnishing tool. The parts of the silver foil which do not adhere are removed with a soft brush. Gold-beaters prepare silver foil either with bright or dead lustre. The latter is made to adhere only by the pressure of the pad, and not by the burnishing tool. This dead lustre cannot compare in fineness with that obtained by the battery; however, it resists handling and the sulphur gases of the atmosphere better. Articles thus silvered are only burnished after all the silver foils have been applied. Round or cylindrical objects are burnished upon the lathe, other forms by the hand; there are always places and lines showing the vibrations of the burnishing tool.

This method of silvering is only employed for very large objects, such as high chandeliers and other church ornaments. Spoons and forks may be covered with silver foil, as follows: First, slightly silver with a dead lustre in a silver bath, by dipping, heat, and then cover with silver foil, by the pressure of an iron scratch-brush striking vertically, forcing the silver foils into the pores of the metal underneath. Burnish by the usual method; it is impossible to obtain a dead lustre by this method.

(To be continued.)

Caution.—Brooches.—Monogram cut out in centre, with a wide gold band outside, which stands on stone well. The letters are spurious, much after the style of medals about some time since. It is impossible to test them well without defacing them. Offered as 18-carat gold by women, who say they are a present when questioned.—*Pawnbrokers' Gazette.*

To quickly clean pinchbeck watchchains, brass plates, dust caps, wheels, or other brass parts of a clock or regulator, Mr. Morgossy recommends the use of about ½ deciliter of acetic acid, or strong wine vinegar, mixed with a spoonful of salt, put into a plate or other flat vessel. Immerse the article, let it remain in it about five minutes, if a chain, long enough to soften the dirt, then take it out and rub it between the hands; keep doing this until thoroughly clean, and it will become bright as when new; then rinse in cold water and dry with cloth or sawdust. Dirty wheels or other watch parts can simply be dampened with the mixture and brushed with chalk.

Repairing Swiss Watches.

By Hy. Ganney.

(Continued from page 43.)

No. X.

As a guide to the springer in selecting a proper spring, the weight of the balance is used. When new work is being sprung, the springer associates certain sizes and weights of balances with springs of a certain number and strength, but the jobber can only gauge by lifting up the balance by the eye of the new spring, and noting its elongation by the weight. Springs are now too cheap to make as wanted, and the wire is not kept as a material as formerly: but the old method of making a spring, by drawing the wire into a spinel with a point of a joint pusher, and working the spring and pusher entirely with the thumb and forefinger, is very useful in setting the outer coils of old springs into shape again. Springing tweezers are made with the points concave and convex, so as to close or open the turns of the spring, as may be required: a spring blueing tool is also very useful, or an ordinary blueing pan, with the spring under a piece of glass, and a weight on it to keep it flat, will do. After blueing the spring, and letting it cool before removal, it will come out quite flat: the other operations connected with the spring, such as making a new stud, and properly fitting the index pins, are very simple and obvious, yet in no point of the watch is so much carelessless exhibited as in these; being simple jobs, they are supposed to want, and get, little attention. The hair spring collet often gives trouble, owing to bad fitting and want of freedom of the cock and the screw heads of index piece. I usually put my watches in beat by moving the collet with a fine screw driver or drill in the slot, without shifting the stud out of the cock, resting the cock on the board paper, and simply drawing the balance a sufficient distance to get at the collet. I find out of beat a greater source of stoppage than anything else, and suppose the trouble and danger attending frequent removal of spring and balance the reason it is neglected: and devised this plan to save trouble, and ensure accuracy of beat. With English sprung arbor watches it is a very much easier plan, as a bar of the balance, when the cock is removed, may be held by a stout pair of tweezers to free the bottom hole, and the alteration made at once by moving the collet. I earned a good fee in a minute or two by this plan of putting a watch in perfect beat, which the owner declared had never gone a month without an occasional stoppage, though he had had it in the hands of all the best men he could find in London for a number of years, who all said it was a first-class made watch, but none had been able to cure it. Thinking it useless to look for ordinary faults, as the watch seemed in perfect order and all that a watch ought to be, I simply wore it, as I took it on the no cure no pay principle; and when it stopped, going on again before it could be opened, I noticed that it had very low angle pallets and rather strong lockings, and appeared very slightly out of beat on the second or discharging pallet. This was altered, and it was put slightly out of beat on the other pallet, as the friction on the second pallet is that which necessitates the oil, and is known as engaging friction, the surfaces opposing each other as they engage in work. The watch has given perfect satisfaction ever since, showing the importance of slight errors, and that one small error may be made to compensate another. Watches being out of beat are not very noticeable when fresh oiled and clean; but as the dirt and difficulties accumulate, the effect is very striking, and where escapements are unequal, the spring may be shifted to make the conditions more equal in performance.

The condition of the jewels in Swiss work is of some considerable importance, and if the repairer aspires to be a good jeweller, considerable practice with the lathe and mandril will be necessary. If it is only desired to replace holes from a stock kept for that purpose, the holes can generally be replaced without much trouble, raising the edge of the setting at one side, to allow of the insertion of the jewel, and securing it in position by rubbing the setting well over the stone with a well burnished rounding centre in a handle; a strong and fine-pointed arbor will do to raise the edge for the insertion of the stone. Where a setting is too badly injured to hold a stone properly, an English hole with brass setting may be fitted in a chamfer, or soldered in; loose jewels may always be tightened with a rounding arbor or centre, and should be always tried for tightness, as troublesome variations of depth and freedoms are caused, which often escape observation. To make a cock to the escape-wheel—often, on account of its being very much turned to free the teeth, it is liable to accidents—it is first desirable to get a sound slip of brass well hammered. Having drilled the screw hole and filed it the proper shape, it must be firmly screwed down, and the steady pin holes drilled through; the drill fitting the hole in the plate easily, the opening of the holes in cock and plate must be carefully done, and the steady pins well fitted, or the cock is useless. The top pivot hole must now be made in the mandril or upright tool; then an old upper plate should have some shellac melted on it, and placed in the mandril; the flame of a spirit lamp, or other heat, applied, the cock is placed on it, and centred from the pivot hole: the slide rest cutter is then used to turn the inside of the cock perfectly flat, and the slot, to free the wheel teeth, is cut a sufficient depth. When removed, the next thing will be to make the wheel the right height by filing away the superfluous brass, then to free the cock of the balance, and try the escapement, and send it for jewelling. If desired, the jeweller will do all the turning and mandril work. If finished off with water, ayr stone, or buff, the cock will be more durable than when gilt. If not convenient to send the cock, the hole should be plugged with a fine wire, and a hole made the same as a verge hole, with a fine drill and bottoming broach, with end well burnished. This kind of hole will give better results than a common jewel-hole, if properly made, and is in use in all the original escapements of the inventor of the horizontal escapement—George Graham. A good inside chamfer must be made to hold the oil; this kind of hole will also do good service for the balance holes, and is preferable to making shift with any cracked or bad jewel-hole, if the points are well rounded and burnished.

It is much to be regretted that watch jewellers do not contribute more to the literature of the art. There is a good opportunity for any enterprising young jeweller to gain fame and business by descanting on the various qualities, and means of judging the quality and value of jewel holes, and showing in what way value is imparted, so that those who want to patronise this art may do so with discrimination. To most watchmakers, one jewel-hole is much the same as another, unless it is cracked, and yet there is as much difference in watch jewelling as watch pivoting; the one, in fact, being a counterpart of the other. There seems to be some secret understanding among watch jewellers not to impart information, as applications to those noted for enterprise *on other matters of intelligence* for information by means of lectures for the Horological Institution, and its contributions to literature, have been refused, on the ground of injuring the interests of that branch. If watch springers and pivotters were as reticent in proving the points of excellence in their specialities, they would get very few high class jobs or large fees—if buyers were not made to understand the difference between springing a watch for sixpence, and six guineas. Saunier's valuable work, though very copious and full on all other subjects, gives very little information on the subject: or is it that very little can be said of cutting one stone with the dust of a harder one? The stonemason rubbing marble into shape with sand and water, illustrates the primitive idea; the ruby hole maker, cutting his hole with the next hardest substance, diamond and diamond dust, shows the other extreme of the same process. As it is a work of skill only, why hide its merits in mystery, for people will only appreciate and pay for what they understand. I expect to hear something practical on jewel-holes in your next number, from one who makes them his speciality.

Bronzes.

By C. D. E. Fortnum, F.S.A.

Continued from page 41.

SPRING-TIDE of *renaissance* was then in full flow, and the earlier religious sentiment, undermined by the revival of classic learning and philosophical speculation, was losing its purity and fervour, while the appreciation of the excellence of antique art had led to the adoption of its forms and ornamentation, more or less modified by individual and local tastes. The results were, however, extremely beautiful, and in themselves the sculptures of this period claim the next place in our admiration to those of the school of Greece. A craving for artistic creation became almost general, and city rivalled city in the erection of temples rather than churches, and in the enrichment of those already built. Andrea's gates to their "*bel san Giovanni*" did but stimulate the Florentines, then in the full growth of their prosperity, to the desire for more. Meanwhile, Ghiberti was studying metal-work under the teaching of his excellent father-in-law, Bartolo di Michiele, the goldsmith, and painting in fresco at Rimini, until, informed that the signory and merchants' guild had decided on erecting another set of bronze portals to the baptistery, and had invited artists to compete for the work, he, by the advice of Bartolo, returned to Florence, entered his name for the artistic tournament, and was to break a lance with his townsman, Brunelleschi, with Quercia and Valdambrini from Siena, with Nicola of Arezzo, and with Simone da Calle. Donatello did not compete. The trial piece was to represent Abraham's sacrifice. The field was soon left clear to the two Florentines, and the judges could hardly decide upon the superior merit of either work. But Brunelleschi's more critical eye convinced him of his rival's superiority, and his noble heart responded when he yielded the palm voluntarily to Ghiberti. The record of this interesting episode in art history remains to us in the original trial pieces, which are preserved in the museum at the Bargello, in Florence, and of which electrotype reproductions are in the South Kensington Museum (Nos. 71, 29, and 30).

In this great work, Ghiberti's first gates, the artist indulges less in his pictorial tendency than is to be seen in his later works, from which he has been termed by Perkins, not inaptly, a "painter in bronze." They are divided each into fourteen panels, surrounded by mouldings and by stiles, the latter enriched with leafage, and having at the intersections a projecting head in high relief. The five upper rows on each door, twenty in all, relate to the history of our Lord; the remaining eight are occupied by figures of the four Evangelists above, and four Doctors of the Church below. As Mr. Perkins justly says: "One can never tire in looking at these exquisite works, which combine the purity of style of an earlier period with a hitherto unattained technical knowledge and skill in handling." After twenty-one years labour, aided by no less than twenty artists, these gates were set up in 1424. All the knowledge and dexterity to which a long course of practical experience had brought both hand and eye, aided by a mind gifted with marvellous inventive power, were brought to bear upon them.

The decision of the signory that events from the Old Testament history should be represented upon the gates on the larger spaces afforded by dividing each valve into only five panels, gave more scope for Ghiberti to indulge in his pictorial rendering of the compositions with a plastic facility that stands unrivalled. He states that he strove to imitate nature to the utmost by studying how forms strike upon the eye, and endeavoured to blind the theory of pictorial and sculptural art—a fallacy offensive in practice by any hand inferior to his. But one gladly forgets all theory and rule in gazing upon the wonderful art displayed in these compositions, in which the effects of perspective and distance upon the *rilievo* and details are conveyed to the eye as by a pencil drawing, and with an accuracy that almost defies criticism. Nor can we but admire the poetic representation of the different actions of a history, depicted on the one panel in varied groups connected by a natural sequence. The subjects, surrounded by simple mouldings, are framed by a richly ornate style continued round the four sides of each valve. On the lateral ones are niches enclosing statuettes (twenty-four in all) of scriptural personages, between which, at the angles and intersections of the panels, are projecting heads: among these are portraits of himself and of Bartoluccio. We may not dwell longer upon the beauties of these wondrous gates. *Che starrebon benealle porte del paradiso*, to use Angelo's words, but pass on to record other and minor works by this great man. His second gates, the chief work of twenty-three years of his life, and not completed till he was seventy-four, replaced his first in 1452, which were then transferred to where they now remain, on the southern side of the baptistery. In the South Kensington Museum is an ably-executed electro deposit reproduction of them (Nos. 167-44), but wearying the eye by their garnish gilded surface, which, in the writer's opinion, had been better omitted. It is true that the originals were gilt some years after their completion, but not by the first design of the artist; it was a splendid extravagance, parallel to that of Nero in gilding the noble works of Sysippus. In both instances the addition would have been "more honoured in the breach than the observance," although time and ware have supplied some remedies upon Ghiberti's work. A partial gilding, say of the architectural mouldings and features, would have been preferable, leaving untouched the *rilievo* subjects, the artistic excellence of which could be so much better seen and appreciated in the rich colour of the bronze.

Ghiberti died in 1455, leaving the rich frieze which now surrounds Andrea's Gate to be completed by his sons and scholars.

To one of these, Vittorio Ghiberti, has been assigned by Gaye the beautiful bronze pedestal, or altar, in the Uffizii, which has also been claimed as the work of Desiderio di Settignano. On this, among exquisite surrounding foliated enrichment and mouldings, are two admirable panels in *relievo*, one representing a sacrifice, the other the triumph of Ariadne. A contemporary replica of the last, peahaps the sole remains of a companion pedestal, or specially repeated from its greater excellence, is in the writer's collection. Filippo Brunelleschi, the architect-sculptor, after competing with Ghiberti for the gates, and whose trial-piece is preserved with that of his more successful rival in the collection at the Bargello, seems to have devoted himself to the greater art, and we have no further record of works by him in bronze. Clustering round Ghiberti's great work was a school in which many artists acquired invaluable technical knowledge of the sculptor's art in metal, and where their talents were confirmed and developed under the master's eye; among these and the more important, were Lamberti, Pollainolo, Michelozzo, and for a while Donatello.

(*To be Continued.*)

Electro Fire-Gilding and Silvering.

(*Translated from the German by* H. Bush, *Hull.*)

COMPLAINTS against the durability of the ordinary Electro-Gilding and Silvering by contact or limited battery, and of the abrasion when exposed to wind and weather or friction, as compared to the good old Fire-Gilding, are very frequent, although the former is generally acknowledged to have a richer appearance than the latter. The reason for these complaints are based upon the fact, that the deposits of the precious metals by the Galvano-Electric system are not of a solid and compact nature.

Experience has taught that electro-gilt ornaments attached to church-yard monuments, lightning conductors, crosses, balls, cocks, eagles, and other emblems on church steeples and public buildings, very soon tarnish, which is fully proved to be the cause of the unsolid and porous deposit of the gold on the metal forming the base of the articles.

To effect good substantial deposits of Gold or Silver by Electricity, we are compelled to take recourse to batteries of great capacity, dynamo-electric apparatus worked by steam power—arrangements which to purchase and to maintain, entail expenses prohibitory to the jeweller or watchmaker who conducts his business on a limited scale, and who, if even in a position to purchase and maintain these expensive appliances, in very rare instances has sufficient work to realise a profit to warrant and encourage the outlay.

In order to overcome the instability of the deposit by Electro-Gilding, and to avoid the considerable expense of costly apparatus, while securing at the same time a good deposit by electricity, the following procedure is recommended as practically good and satisfactorily effective.

To the ordinary gold solution for Electro-Gilding add some mercury previously dissolved in nitric acid; this solution, diluted with water and neutralised of the acid by adding small quantities of spirits of ammonia until immersed litmus paper does not change its blue colour into red. Previous to dissolving the mercury in the acid, it is necessary to free it from the lead, with which commercial mercury is generally contaminated, and this is effected simply by pressing the mercury through a piece of wash-leather, which will allow the mercury to pass through on squeezing it, and retain the lead.

This prepared gold solution will be a mercurial-gold amalgam of a fluid or watery nature, and should not be mixed in larger quantities than required for immediate use. The articles to be gilt are immersed in this solution appended to the wire in connection with the cathode (zinc) of any battery, and will receive a gold deposit of quicksilver appearance, after the article has remained sufficient time in the solution. It is then withdrawn, rinsed in water, and laid on a fresh fire made of small pieces of charcoal, until the mercury has evaporated, which takes place very soon, as the quantity of mercury is very small in proportion to the gold deposit, although the colour of the former predominates. After the evaporation of the mercury, the article has all the characteristics in colour and toughness of *Fire-Gilding*—pale yellow and dead surface. The article is then scratch-brushed in beer and will assume a fine lustre. If a *strong* deposit of gold is required, the operation may be repeated after each scratch-brushing. By weighing the article before the *first* immersion into the gold-solution, and again after the *last* scratch-brushing, the weight of the gold deposited can very accurately be ascertained. In the last evaporation, the article is left for about half-a-minute or so longer on the fire than necessary for driving off the mercury, which will deepen the colour of the gilding.

After a final scratch-brushing, the article may be gilded in an *ordinary* gold solution *without* the addition of mercury, by which the richness of colour of Electro-Gilding and the durability of Fire-Gilding are combined.

This kind of gilding is accomplished with much less trouble, and, what is of great importance, attended with less or almost no danger than *Fire-Gilding* on the old method, which requires the continual handling of a large quantity of mercury so injurious to health, as the deposit of mercury in combination with the gold deposit in *Electro Fire-Gilding* is so slight as to evaporate almost instantaneously, and affords the great advantage of a regular deposit of gold, not only on the surface, but in the hollows and interstices of the articles to be gilt. If any places or portions of the articles do not require gilding, these places can be stopped from receiving the deposit by a coating of copal varnish mixed with a little rouge powder and drying in a warm place before immersion in the gold solution.

The same method may be advantageously applied to *Electro Fire-Silvering*, by employing Silver-Solutions, and the results are excellent.

Care must be taken that the *mercurial* gold or silver solutions are kept carefully apart from the *ordinary* gold and silver solution.

Silvering by fire has been very much neglected, and preference given to Electro-Plating, but *Fire-Gilding* is still practised to a considerable extent, and the careful perusal of the above cannot fail to convince us that the combination of *Electro Fire-Gilding* not only fully replaces the ordinary and antiquated process of Fire-Gilding, but effects at the same time a great saving of precious metal, which would unavoidably be lost in Fire-Gilding, while at the same time presenting all the advantages to be derived from that method.

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Soft Pinions and English Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—After perusing Mr. A. L. Dennison's letter on the quality of English, Swiss, and American watches, one is almost tempted to believe that the American watches are superior to any other, especially non-practical watchmakers who are simply vendors; this is not so. He quotes as one reason the great number of watches manufactured in America within a certain period. I think our free trade system will explain that to a much greater extent than the quality of the watches. In respect to the pinions being harder than in the Clerkenwell watches, I will take it for granted that it is so, especially as Mr. Dennison vouches for each pinion in 40,000 watches. Now, what I wish to convey to the readers of this Journal is, that a most unsound watch can be produced by the pinions being left *too hard*, or being made *rotten*, in the process of hardening and tempering. It is a common occurrence to find the teeth broken out of a centre pinion, and even a third in American watches, a thing you will never see in English, and very seldom in Swiss watches. The American watch is what one might term a sort of Anglo-Swiss production, copied outwardly to imitate an English, and inwardly a Swiss watch, especially in the going barrel, without having any advantage, or being as good as either. For a cheap class of watch, the Swiss is undoubtedly better than either English or American; for a good class pocket watch, I don't know of any producing such good general results as the ordinary English lever watch.

Yours &c ,

THOMAS ARMSTRONG.

79, Kirkdale Road,
Liverpool.

Gems and Jewels—in Relation to their Biblical History.

By J. W. Singer.

THE few notes which I venture to bring before your notice on the subject of precious stones, I hope, if not sufficiently interesting to all, may be excused; the difficulty being, that if made instructive, it would not be interesting; and if made interesting, it would not be so instructive, as the teaching parts are rather dry and technical. It may at first seem to some a rather frivolous subject; but a great modern writer has said that the "March of luxury is the text of civilization"; and the taste for gems is the most refined of all luxuries, the scientific study of them being a great step forwards in civilization; and every power, whether religious, or civil, or individual, has called them into use; precious stones being alike required for the crown of the Sovereign, the crozier of the Bishop, or the ornament of every rich lady; and thus as long as the sense of the beautiful, the feelings of rivalry or triumph in outward appearance shall be natural to the human mind, so long will precious stones be held in high esteem by nearly every one. The origin of the taste for gems is lost in the most remote ages, for the very earliest songs and poems mention them, and forty centuries ago the Egyptians had even engraved jewels. The term precious stone is not a very simple one to define, as at different times various stones have been more or less precious, and you cannot give any very general definition, for one cannot say that they are all hard, or all brilliant, or all transparent, as they have every sort of quality, some being the hardest matter known in nature, and others you can cut with a knife; thus there is no hard and fast term for a precious stone, excepting arbitrary fashion that made it so. There is a much larger number of them than many may imagine, as one author gives a list of ninety-nine different names for various precious things used for jewels. These things have been sometimes called by other names, such as *gems*; another time *jewels*, as well as precious stones But *gems* are, strictly speaking, engraved or sculptured stones, which acquire value, not from the stones so cut, but from the valuable work given to them, and are often stones of small value, as the most suitable for that purpose, such as the jasper and onyx class, although every stone has been more or less engraved. And the term *jewel* is more strictly defined when applied to the stone and some metallic mounting *together*. Thus, a ring, or a pendant, may be a jewel, but a diamond alone should not be called a jewel. Also, a pearl alone, is neither a precious stone nor a jewel, as it is not a mineral body like the others, but simply an animal production, very like egg-shell, and the best pearl is only ninety-five per cent. of lime and a little animal matter along with it, by which means nature has converted it into a very valuable commodity: thus, in all descriptions of such things we read of "precious stones and pearls," from the latter being a different body. Notwithstanding that precious stones were mentioned so often in early writings, and although there were many Greek and Roman authors, whose names Pliny has mentioned and thus preserved, yet all their work have been lost, until we come to Theophrastus, who lived about three-hundred years before Christ. This *one* author, who wrote a short treatise on the subject, gives *all* that is known of Greek mineralogical knowledge. In the Fourth Century Epiphinius, a Bishop of Cyprus, wrote a tract on the Twelve stones of the Rationale, or Breast-plate of the High Priest, which is praised by St. Jerome. But the book is full of blunders from his confounding one stone with another, his chief object being to point out the medicinal virtue of each stone; the principal interest attached to this author is that he speaks of three species of the hyacinthus, and he calls the adamus a "sky-coloured gem," showing that he meant by that name the sapphire. Since then, books on this suject have vastly increased, and one author gives the names of two-hundred and ninety-one treatises on precious stones, and this number since the Fifteenth Century only. But nearly all the early books on precious stones treated more on the use of the stones to serve as charms, or for their medicinal uses than their scientific arrangement.

The Jews had a tradition that when on the day of Atonement the High Priest asked the Almighty forgiveness for the sins of the whole nation, if they were forgiven the stones in the Urim and Thummim shone most brightly; if the contrary that they became black. If such thoughts were to be found amongst the learned, of course much more extravagant ideas prevailed amongst the ignorant; and even now immense numbers of seed pearls are used in China and the East for various medicinal purposes, Lapis being presented as a laxative, and coral power given to new-born children; and as to this last article, the superstition has not entirely died out amongst ourselves, as the "coral and bells" are only the remnants of the older ideas that coral dispelled witchcraft, and the bells were to scare away evil spirits. There is a small treasury of interesting information on the subject of precious stones in the Bible. The Breast-plate of the High Priest will be known to all; but it may not be out of place to recall the stones there mentioned. The names of these stones by the seventy translators, also according to Josephus and the Vulgate, all have the same name, but they differ as to the exact places occupied by each stone in the plate. According to our usual and the Authorised Version, they were the sard, the topaz, the carbuncle, the ruby, the emerald, the sapphire, the diamond, the ligure, the agate, the amethyst, the beryl, the onyx, and the jasper. There were also two onyx stones on the shoulder knot, set in gold, upon which were engraved on each, six names of the Tribes of Israel, according to the order of their birth. The translation of the names of the twelve precious stones differs in many Oriental languages, from our own texts. The difficulty of correct translation lies in the fact that all the different stones of *one* colour have the same name. Thus, by the Latin term Carbunculus, are included all the stones of a *red* colour, whether they were rubies, hyacinths, or garnets. Precious stones do not appear to have been common, as only the chiefs of the Twelve Tribes are mentioned as supplying the Shoham Stones, and the Stones to be set; for after speaking of the offerings of gold, and silver, and brass by the willing-hearted, of those who had blue and purple, and scarlet, and fine linen, it is said in Exodus xxxv. 27, "And the Rulers brought the onyx stones, and the stones to be set for the ephod, and for the Breast-plate," and then in the 31st verse it says, "He hath filled them with the spirit of God in wisdom, in understanding, and knowledge, and in all manner of workmanship; and to devise curious work, in gold, and in silver, and brass, and in the *cutting* of stones, to set them, and to work all manner of work of the *engraver*." A very complete account of the Hebrew knowledge of precious stones will be found in Exodus xxviii. 17—20 verses: the name is nearly repeated in the 39th chapter, 10—13 verses; and it may interest you to know that with the exception of three, the same gems worn on the Breast-plate of the High Priest are found among the royal jewel sworn by the Kings of Tyre—Ezekiel xxviii. 12: "Son of man, take up a lamentation upon the King of Tyre, and say unto him: Thou hast been in Eden, the Garden of God; every precious stone was thy covering—the sardius, the topaz, and the diamond, the beryl, the onyx, and the jasper, and the sapphire, the emerald, and the carbuncle, and gold." The three wanting being the ligure, the onyx, and the amethyst.

(*To be Continued*).

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(*Continued from page 45.*)

CHAPTER XI.

THE KEYLESS MECHANISM.

122. This complement of the modern watch, so much in demand now, and, it must be confessed at the same time, so useful and agreeable, is getting so much in favour that its manufacture and construction is well worth saying a word about. Even now there is still a pronounced mistrust against it in a considerable part of the public, and there are even many respectable watchmakers who cannot resolve to advocate a keyless watch.

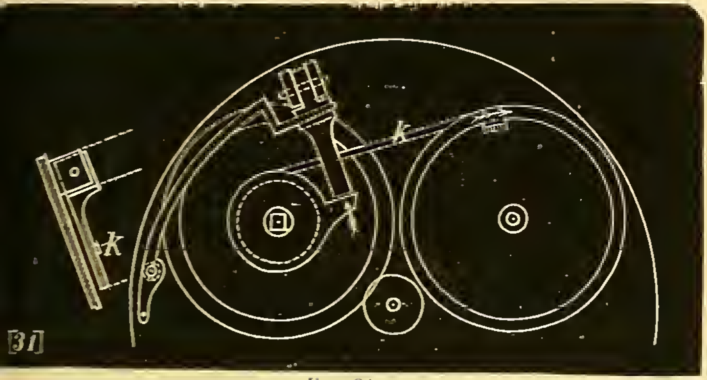

Fig. 34.

The keyless mechanism, though, is much more than a mere toy, or a convenience to the wearer. It is useful in many directions. In the first place, it affords the possibility of winding a watch and of setting its hands at any time and in any place, because these operations do not require the opening of the case, while the winding or setting of any other watch must be done while the body is perfectly at rest, and is impossible in a carriage or on horseback, or even when walking. It cannot be done except under cover, and at a place free from dust, while a keyless watch can be treated in the open air without any fear of rain or dust. All this is more than a mere convenience, because it insures the continual service of the watch during a voyage, when the wearer seldom finds a moment of rest for winding his watch, and in these rare moments may forget to do so, or may have forgotten to take the key with him: and it is sufficiently acknowledged that a watch is doubly important when you are travelling.

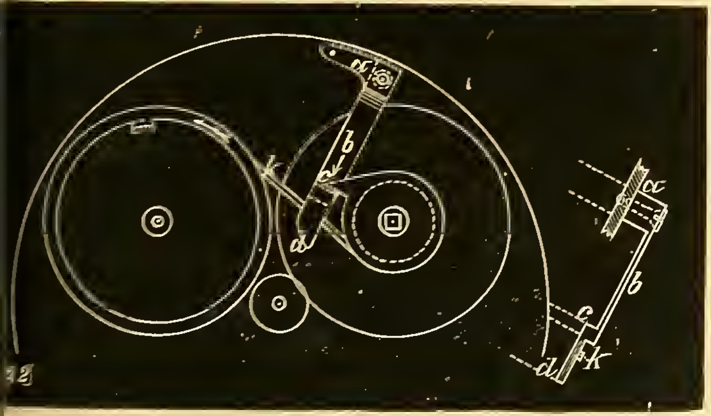

Fig. 35.

123. Another advantage may be expected from the employment of the keyless mechanism, and I venture to say it is also a very important one. The rotary motion required for winding a keyless watch takes place in a plane vertical or at right angle to that of the balance. This is a complete guarantee against the detrimental effects of the bad, but very frequent, habit of the wearers of watches, of moving not only the key, but also the watch when winding it. This practice, it will readily be understood, involves a sudden rotary motion of the movement in the plane of the balance, and which is repeated ten to twelve times till the operation of winding is completed. If, in the best case, this careless treatment does not result in direct injury to the acting parts of the escapement, it causes at least deviations of rate in a lever watch by violent banking; and those irregularities, which nobody can account for, often discredit a watch in the opinion of its owner, and are often ascribed to a want of skill or care of the repairer to whom it has been intrusted.

124. A very important consideration of the keyless mechanism is the greater durability of the cases, and their interior remaining better preserved from injury and deterioration. The oft-repeated opening wears the rims and joints of the case, and, besides, there is a necessity of not too hard shutting for the case of a key-winding watch, which does not exist with regard to a keyless one. This latter may shut more closely, and thereby protect the watch more efficiently against dust, &c.

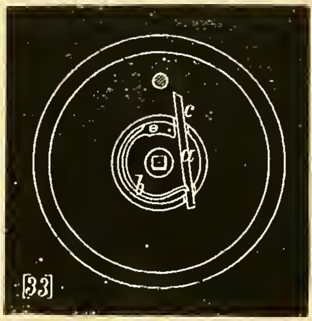

Fig. 36.

125. The necessity of opening the case of a key-winding watch at least once every day admits the direct entrance of dust. The key also, in a majority of cases, is a very active agent for the introduction of filaments and impurities of all kinds, owing to the bad practice of carrying the key about in a waistcoat pocket, which nobody thinks of cleaning.

126. For the purpose of studying and comparing the different keyless mechanisms, it will be indispensable to classify them into certain groups, lest the great variety of these contrivances could not be conveniently inspected.

The greatest part, and in fact almost all keyless watches, may be divided into two principal categories:

I. Those with which the setting of the hands is done by devices arranged on the winding arbor and shifting on the same.

II. Those who accomplish this result by means of a rocking plate.

127. The last-mentioned class, indispensable for fusee watches, is of a more delicate nature, and requires a more careful execution. The former, therefore, is more resorted to, especially in Swiss watches. In considering this first class of keyless mechanisms, a subdivision may easily be established between those where the hands are set by pulling the winding knob a little outward, and those provided with a push-piece for putting the hands in motion

(*To be Continued.*)

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Lectures on Watch and Clock Making.

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

Delivered at St. Thomas Charterhouse School by I. HERRMANN on Monday Evenings, from October 25th.*

(Continued from p. 47).

"WORK" EXPENDED ON FRICTION IN PALLET ACTION.

If a body is drawn along a level plane, the resistance overcome is equal to the work expended on friction.

If the same body is drawn up an inclined plane, the work expended is on resistance, plus gravity, to the extent of the height of the plane. These facts have their parallel conditions in pallet actions.

In Figs. 38, 39, and 40, c is the point of application, $c\,d$ the work expended; of which $c\,p$, $c\,q$, and $c\,r$, represents the part absorbed by friction, plus $d\,p$, $d\,q$, and $d\,r$, that in overcoming gravity, and here applied to turn the pallet about its centre.

But resistance, or work expended on friction, is proportioned to the pressure of P on $c\,p$, $c\,q$, and $c\,r$, respectively × ·14, the coefficient of friction. For slow motions in clock-pallets the circumferencial force of the wheel may be considered constant for all practical purposes, but its effect is determined by the angles formed by the direction of P with $c\,p$, $c\,q$, and $c\,r$ (Figs. 38, 39, and 40—See page 130, Volume VI). That is (Fig. 38)

$$d\,p : p\,c :: \text{P} : \text{pressure.}$$

By construction, we find $p\,c$, $q\,c$, and $r\,c$ (Figs. 38, 39, and 40), in ratio to their bases of ·1777, ·3489, and ·5373 respectively, equal ·3914, ·4934, and ·6406.

Hence we have for Fig, 38,

$$\cdot 1777 : \cdot 3914 :: \text{P} : \text{pressure}$$

and pressure,

$$= \frac{\cdot 3914}{\cdot 1777}$$
$$= 2{\cdot}2025 \qquad (a)$$

For Fig. 39, we have,

$$\cdot 3489 : \cdot 4934 :: \text{P} : \text{pressure}$$

and pressure,

$$= \frac{\cdot 4934}{\cdot 3489}$$
$$= 1{\cdot}414 \qquad (b)$$

And for Fig. 40 we have,

$$\cdot 5373 : \cdot 6406 :: \text{P} : \text{pressure}$$

and pressure,

$$= \frac{\cdot 6406}{\cdot 5373}$$
$$= 1{\cdot}1927 \qquad (c)$$

Then the work expended on friction is

=Pressure × distance traversed × co-efficient of friction.

The space described by the tooth of the escape-wheel, being a constant quantity, forms the unit of motion in determining the work expended on the distance traversed.

Hence we have at (*a*),

$$= 2{\cdot}2025 \times \frac{\cdot 3914}{\cdot 349} \times \cdot 14 = \cdot 314$$

at (*b*)

$$= 1{\cdot}414 \times \frac{\cdot 4934}{\cdot 349} \times \cdot 14 \times \cdot 279$$

and at (*c*)

$$= 1{\cdot}921 \times \frac{\cdot 6409}{\cdot 349} \times \cdot 14 = \cdot 309$$

Then $\quad \text{P at } (a) = 1 - \cdot 314 = \cdot 686$

$\quad \text{at } (b) = 1 - \cdot 279 = \cdot 721$

and $\quad \text{at } (c) = 1 - \cdot 306 = \cdot 699$

And for Q (Fig. 38)

$$\cdot 1777 : \cdot 349 :: \cdot 686 : \text{Q}$$
$$\text{Q} = \frac{\cdot 349 \times \cdot 686}{\cdot 1777}$$
$$= 1{\cdot}684 \qquad (g)$$

For Q (Fig. 38)

$$\cdot 3489 : \cdot 349 :: \cdot 721 : \text{Q}$$
$$\text{Q} = \frac{\cdot 349 \times \cdot 721}{\cdot 3489}$$
$$= \cdot 724 \qquad (h)$$

And for Q (Fig. 40)

$$\cdot 5373 : \cdot 349 :; \cdot 699 : \text{Q}$$
$$\text{Q} = \frac{\cdot 399 \times \cdot 699}{\cdot 5373}$$
$$= \cdot 45 \qquad (k)$$

Then virtual moment about g (Fig. 37)

$= 1{\cdot}684\,(g) \times 2{\cdot}54 = 4{\cdot}277$

about h $\quad = \cdot 724\,(h) \times 5 = 3{\cdot}62$

and about k $\quad = \cdot 45\,(k) \times 7{\cdot}69 = 3{\cdot}45$

The question arises: "Why do the two methods not give the same result?" The reason is, in the first we have a statical condition; the loss is proportioned to the angle of resistance, which is a constant quantity deducted from Q. In the second we have a condition of motion: the friction takes place under decreasing pressure, but the distance traversed increases; hence, the first gives Q at a point only, and the latter for the whole of the pallet motion. We have, therefore, proved the theory quoted by Saunier, viz., that long pallets give no advantage over short ones. We have to notice this again in its application to the dead beat escapement.

This holds true, conditional that the angle formed by the direction of the circumferencial force of the escape-wheel with the impulse plane varies in the ratio of the radius. This condition is satisfied, if we take any constant angular points, in different lengths or sizes of engaging pallets, or of disengaging pallets, and approximately or practically it holds good in high numbered wheels within certain limits between the engaging and disengaging pallet. The condition that limits this, is the fact, that in the engaging pallet the angle between the direction of the circumferencial force and impulse plane increases as the radius diminishes, whereas, in the disengaging pallet, the former decreases as the latter increases, hence the moments vary in an inverse ratio. Hence, as in high numbered wheels, the breadth of the pallet is small, and generally the impulse angle also; this variation takes place within very narrow limits. But in pallets of small span, and applied to wheels of low number, the variation is more effective. This we will notice again, when we have the lever escapement under consideration.

IMPULSE ANGLE.

The foregoing contains the proof, that the moment of a pallet diminishes as we increase the impulse angle. We need only refer to one principle fact to show that this is so. We have seen in Figs. 38, 39, and 40, that Q is proportioned to the angle P makes with $c\,p$, $c\,q$, and $c\,r$. But as we increase the angle of impulse, we increase the angle named, just as it is increased by taking a larger radius, because, while $c\,d$ (Fig. 37) remains constant, $d\,p$, $d\,q$, and $d\,r$ vary as this angle. What then, is the point we have to consider in deciding or judging of a pallet angle? *Answer*: The mass and the pendulum length. The terms "pendulum" and "mass" touch new subjects, which we cannot attempt to discuss, further than is necessary to the immediate points before us. It is easy to prove by experiment, that clocks with large impulse arcs will stop, if the pendulum bob is made heavier. The reason of this can be shown by the application of the parallelogram of forces. Let P (Fig. 41) represent the bob of a pendulum, $h\,t$, its weight in magnitude and direction suspended from c. Draw $t\,r$ parallel to $h\,c$, meeting $h\,r$ in r, drawn at right angle to $h\,c$, and complete the

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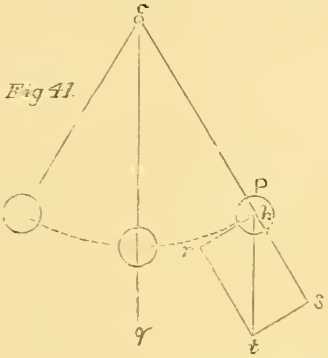
Fig 41.

parallelogram $h\,r\,t\,s$: then $t\,r$ is the resolved part of $t\,h$, acting in the direction of c to h, and $h\,r$ is the resolved part of $h\,t$, acting at right angle to $c\,h$. It is evident, that, as angle $q\,c\,h$ becomes greater, $h\,r$ increases, and inversely if ∠ $q\,c\,h$ diminishes $h\,r$ decreases. Therefore, $r\,h$ is proportioned to the angular displacement of P, from the vertical line $c\,q$, and to the mass of P. In other words, it represents the motive power or impulse force at the crutch, necessary to maintain the oscillations of the pendulum. Thus it happens, that clocks with a given motive power have sometimes a heavy bob and large arc, and are, in consequence, troublesome. In such a case, if we diminish the impulse angle in harmony with the principle described, we increase the effect of the energy in the escapement, while we diminish the necessity for its magnitude.

ANGLE OF RECOIL.

The term "recoil" applies to the motion of the escape-wheel during the supplementary arc of the moderator, and its effect is seen in the time of the long arc of oscillation of the latter, in relation to the short ones.

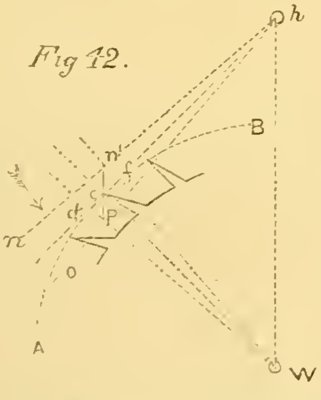
Fig 42.

Let A B (Fig. 42) represent a section of the periphery of the escape-wheel, h the centre of the pallet, and W that of the wheel. To show the connection, let ∠ $d\,k\,o$, $d\,c$, and $c\,p$ (Fig. 37) correspond to the same points. Let $c\,n'$ be a continuation of the driving or impulse plane $P\,c$. The impulse on the opposite or corresponding pallet must have given the pallet plane $P\,n'$ the direction of motion shown by the arrow, and its completion has brought a point of a tooth in contact at c. Let ∠ $c\,h\,n$ represent the supplementary arc, given to the pallet by the inertia of the pendulum, which will practically bring point n' of driving plane $P\,n'$ in the periphery of the wheel, and the tooth will be driven back to f, and ∠ c W f is the ∠ of recoil. It is evident that we can give $c\,n'$ any inclination we please in relation to $c\,P$, which, together with ∠ $c\,h\,n$ determines ∠ c W f.

EFFECT ON THE TIME OF PENDULUM ARCS.

Let C (Fig. 43) be the suspension of a pendulum and let B B^1 and A A^1 be the arcs described by the bob of the pendulum. According to general experience, by reason of resistance of

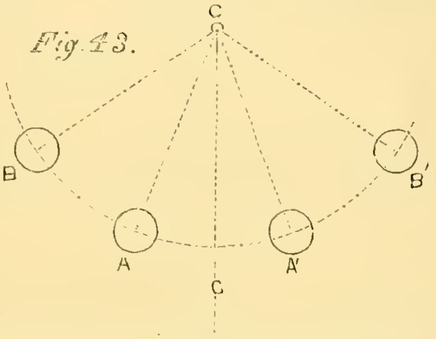
Fig. 43.

the air, and friction at the centre of motion, the time occupied by the pendulum in describing B B^1 would be longer than the time occupied in describing A A, that is, a simple pendulum apart from the escapement. Now, however, the recoil has the effect of making the larger arcs quicker in duration than short ones.

A and A^1 represent two positions of the pendulum bob, either in the arc A A^1 or the arc B B^1; but if A A^1 is considered a section of the arc B B^1, the bob will move much quicker from A to A^1 than if A A^1 is the extent of the arc described; because the bob has an initial* velocity at A, that is, it passes the point A with a velocity which is due to its motion from B to A, and an accelerative force proportionate to ∠ B C G, and represented by $r\,h$ (Fig. 41). Thus, in a recoil, we have a pendulum arc represented by A A^1, that is practically a section of a larger one. Because the bob at the completion of impulse arrives at A^1 with a velocity which is in proportion to the arc B B^1, but the recoil cuts the motion short, and saves the amount of time necessary to reach B, and again in its return motion, by reason of the re-action of the escape-wheel, it passes A^1 with a velocity which is approximately proportionate to the velocity it would have gained had the bob moved from B^1 to A^1. This result is repeated at A, and thus every increase in the arc of a pendulum attached to a recoil escapement represents but a section of a greater arc; hence long arcs are performed quicker than short ones.

These conditions are ably pointed out by Saunier. Any clockmaker who has had a moderate experience with clocks, must have observed, that some will keep time much better than others, though they are inferior in workmanship; indeed, the results are sometimes contrary to the received notions of expansion and contraction; but this is not because that accepted law is deceiving, but it is neutralized by the secondary effect above described.

We have now shown that time is a product of which the impulse angle, the angle of recoil, the motive power, and the inertia of the moderator or weight of the pendulum are factors; therefore, these four quantities are each a fraction of that one whole, viz., time. We stand thus at the commencement of a far-reaching line, along which the direction of the investigation lays. We can only point to this, but have no time to follow it during the present course, and will now pass on to the dead beat escapement.

To be continued.

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* The velocity possessed by a body at the commencement of a path to be described.

Trade Notes.

We are very glad to be able to inform our readers that there are signs of improvement in the watch trade.

Mr. T. E. Bingham, head of the firm Walker & Hall, Sheffield, Silversmiths, &c., is Master Cutler for the current year.

Messrs. Henry Wilkinson & Co. (Limited), silver platers, declared a dividend of 4 per cent. There was no dividend last year.

The Maharajah of Burdwan is having a chair made in Calcutta, which is to be entirely of gold, and will cost between 15,000 and 16,000 rupees..

An Exhibition of Ecclesiastical Art will be held at Newcastle-on-Tyne during the meeting of the Church Congress, from October 3rd to the 8th. Gold and silver plate for Church uses will be included.

Mr. J. H. Eisele, of Kiel, Germany, is providing a marine chronometer, with his newly-invented Independent Chronometer Escapement, which will be submitted for trial at the Imperial Observatory, Hamburg. A description of this invention, illustrated by diagrams, was given in our last number, p. 39.

In distributing the prizes at the Mechanics' Institute at Bradford on the 29th ult., Lord Spencer dwelt at length on the importance of technical education, remarking that if our manufacturers wish to keep their place in the markets of the world, they must make all their articles at least equal to those of their foreign competitors. Technical education he looked upon as one means of securing British supremacy in manufactures.

Mr. W. S. Harris, of Croton Falls, N. Y., writes to the *American Machinist* concerning his experience in nickel plating, and gives the following as the result of much study and experiment, which he says gave perfect success every time, for all small brass work or any other of the soft metals: "If the work be new it should be brought down to a fair surface with the file and fine grains of emery paper, and then finished on a felt wheel with tripoli; that prepared in cakes is the best and most convenient, as it can be held against the wheel while running, and thus the wheel will be well charged without stopping the lathe. After the work has been well polished in this way, it should be cleaned in benzine or ley to remove adhering particles of tripoli and dirt. Now the final high polish may be given with the rag wheel and rouge, when the article will be in readiness for the last and most important part of the cleaning, which is done with precipitated chalk made into thick paste, with just enough ammonia water to give it a sharp smell. Now hold the articles in a pair of wooden pliers, or in any way to keep them from coming in contact with the hands while they are well brushed over with the chalk mixture. Then they should be rinsed in running water, and if there is no part that is not covered with a film of water, they are ready to be placed in the circuit as soon as possible; but if there are spots where the water does not cover the object, the work shows imperfect cleaning, and should be gone over again as before with the chalk and rinsed. The bath should be composed of sulphate of nickel and ammonia, with pure rain or distilled water, and the strength should be 70° Baume's hydrometer, or about ten ounces of the salts to each gallon of water. The bath should also be kept as near neutral as possible by testing with litmus paper and adding small quantities of ammonia or sulphuric acid as the case may demand. The length of time the object should remain in the bath depends on the thickness of plate wanted, and strength of battery. A weak battery and longer exposure will give the best results. If the battery be too strong, the objects will assume a rough, grey appearance.

Forty-two Marine Chronometers have been tested for purchase by the Board of Admiralty, at the Royal Observatory, Greenwich, this year. The printed rates had not been issued from the Observatory at the time of writing this paragraph, but we intend referring to the subject again next month. We are, however, in a position to say that the names of the successful competitors stand in the following order:—V. Kullberg, T. Mercer, J. Poole & Co., Edward & Son, and J. Poole & Co. It will thus be seen that Mr. Kullberg has again sustained his well-earned reputation by heading the list of competitors in a trial which is acknowledged on all hands to be absolutely fair, and without suspicion of undue influence having any effect on the result. Mr. Mercer is also to be specially congratulated on his success; for although he rarely competes in his own name, it is well known that his instruments are no strangers at the Observatory. The same remark applies equally to Messrs. James Poole & Co., who have the good fortune to have two chronometers "placed," and Messrs. Edward & Son, of Glasgow, stood second in 1877, and third in 1879. The conclusion of the trial has been looked forward to with unusual interest by the trade; first, on account of the exceptional severity of the weather during the first few weeks of the year, which must have greatly influenced the performance of the instruments; and secondly, the Clockmakers' Company, with a view to encourage *bona fide* manufacturers, offered two prizes for the makers of the first and second chronometers—the first being £10 10s. and the freedom of the Company, and the second £5 5s., without the freedom. It is rumoured that a slight hitch has occurred relative to the awarding of these prizes, but we hope to give fuller particulars next month. In the meantime, it is noteworthy that three well-known manufacturers have run each other very close for the proferred honours, and it is not the least interesting feature in the contest.

Improved Benzine Jars.

1. Take a circular piece of fine perforated metal—a coffee pot strainer answers well. (If you cannot get it in your immediate neighbourhood, send a stamped directed envelope and enclose three penny stamps to Stanton Bros., Metal Warehouse, 73, Shoe Lane, London, and you will get one by return post). Then fit it inside your benzine glass, rivet in five or six wire feet, not more than a quarter of an inch long, so that you will have a small space between the perforated metal and the bottom of the benzine jar; half fill the jar with the purest of benzine—the spirit must be at least a quarter of an inch above the perforated metal; lay the watch plates, &c., on the perforated metal, and the benzine which holds the thick oil and other impurities in solution, will speedily precipitate them to the bottom, and their further contact with the work is prevented by the perforated plate, and when dried they are perfectly clean.

2. Take a small wide-necked bottle, fit a cork, and insert a brass wire; turn up the end like a fish hook, so that it will dip half-an-inch into the benzine; hook on the wheels, balance, and small pieces, and dip them in the spirit, which will operate as before described.

A little attention to small tools is often the difference between a quick workman and a slow one. Workmen of equal industry and ability often produce widely different results, from the neglect of a small outlay in useful tools.

The Story of a Presentation Watch,

AS TOLD AT THE JAW-MUNDUM CLUB.

By C. Stuart Murray.

NIGHT THE SECOND.

"An honest tale speeds best being plainly told."

ON the following morning I did not get up very early, but when I did rise I passed my breakfast idly by and took out my chronograph. After admiring it for several minutes I wound it up and set it going. As I was no judge of such things I looked at it again, and having relaid it in its morocco case, put it away. As I had to go on my usual fortnightly journey in the purified oil line, I did not see it again until my return, having considered it far too good to go with me; indeed, it was nearly three weeks before I had made up my mind to take it into companionship. One morning, therefore, as I was told by high authority that that was the best time of day to wind up a watch, I again set it going. Upon returning in the evening from business, a friend came in to "have a squint at your grand chronograph." There was the hand trotting around, and in the sunk centre of the dial were the words "centre-seconds chronograph," the number, and the maker's name. To show the chronographing, I put the stop on and brought the hand to a standstill, set it going, and stopped it again. My friend, having expressed his admiration, went away. I thought that I would then amuse myself a little. "Halloa! what is this?" I now found out that in stopping the chronograph hand the whole watch stopped. "There is something wrong here," said I, and I shall be with Mr. "first-class man" pretty early in the morning. I also noticed for the first time that the bow did not swivel, and *that* I wanted explained. Upon arriving at the man's house in a respectable bye-street in the neighbourhood, I learned that he had gone to Liverpool after an appointment, and would not be at home for some days. The door was answered by a neatly-dressed, pleasant-looking woman, whom I recognised as one of our ladies at the presentation-supper. From there I went to a watchmaker whom I knew. "Ah," he exclaimed, "you should have got me to have made a watch for you." I told him that the presentation committee had arranged the whole matter among themselves. He read the name on the dial and burst into an immoderate fit of laughter. "Centre-seconds chronograph, Snail, London," he exclaimed sneeringly, "Why, Snail does not know what a chronograph is. Besides, he never made a watch in his life, and never *knew how* to make one. I would not trust him with a common French drum. He a watchmaker, forsooth! Why, he is only fit to act as labourer to a 'mucker out' of old Dutch clocks, up some blind alley somewhere, and hardly fit for that." I began to shiver and get hot and cold as if the ague had picked me up. "Besides," he went on, looking closely through the movement with his glass, "besides, this is not a chronograph at all, but only a common stop-watch, and as far as I can see, not much of that. However, you can leave it for a day or two and I'll look at it." I left it and hurried off to business, where I muddled away as best I could under very excited feelings.

I called for the watch in due time, and asked what was to pay. "Oh, nothing, nothing. I don't charge anything for looking at it; but I ought to have made the presentation watch for you, I ought. Mind, you must not put that stop on, because if you do you'll stop everything." And away I came.

A day or two after that I had occasion to call on a gentleman in the City, and upon looking at my time-piece—"Oh, ho!" said he, "have you got something new there?" I showed it to him, and the inscription pleased him much. "By-the-by," he continued, "I am going round to Potence & Co.'s, come with me and we'll show it to Mr. Potence, if he should happen to be in, and he'll tell us whether you have had justice done to you or not." He went in, and after the usual salutations my introducer said, "Here is a friend of mine, Mr. Potence, who has received a presentation watch, and I have brought him round for you to see it; you would not mind looking at it, would you?" "Oh, certainly not," replied one of the horological authorities of the age, and I gave it to him. He opened it, stopped it, and smiled to himself. That boded no good, I saw at once. "They might have given you better cases," said he, "as they are only about half the substance that they ought to be," at the same time calipering them between his finger and thumb. "Jones," he called out, "tell Mr. Pivot that I want to see him." "Yes, sir," and away went Jones. "Mr. Pivot," said "the firm," "is our manager and examiner both of work and workmen. In fact, in that department he is the backbone of the establishment." By this time Jones had returned with—"He is very busy, sir, examining the springing of the pocket chronometer that has been made for the Astronomer-Royal of the Himalayan Observatory, as he expects the gentleman to call to-day, but he will be down in a few minutes." "Oh, go up with this watch to him, tell him to have it uncased, examine it as well as he can in a minute or two, and run in to me, I want to hear what he thinks about it." And away trotted Jones again.

After a short time spent in conversation with my friend, in walked Mr. Pivot. Lord, you might have knocked me down with a feather! He was one of the gentlemen at the supper who looked at the watch through his glass, nudged his friend with his elbow, and smiled "queerly," as has been previously mentioned He had the watch in his hand.

"Had not I the pleasure," I faintly stammered, "of seeing you a few weeks ago?" "Oh, yes," he replied very politely, and turning to his principal he continued, "I was at the presentation supper to this gentleman, so that I have seen this watch before."

"Oh," said the chief, "then you have some idea of what it is? Who is Jacob Snail?"

"He is a joint-finisher living in Pooltown; and that is about his only connection with watchmaking." Turning to me, Mr. Pivot said: "How, in the name of wonder did he come to have anything to do with this watch?" I replied that I did not know, beyond the fact that a member of the presentation committee said that he could recommend him as "a first-class man." "Then," said the manager, "it might be worth your while to inquire upon what grounds such a recommendation was made. As for the watch, well, you will see how it gets on." And with that he handed it back to me. Mr. Potence had another look at it, and with an ominous smile he "hoped that they were not slandering its character," and bade us a very good morning.

In the evening I went home and found a few lady-friends of my wife who, having heard of the affair, just "looked in to congratulate me on my good fortune." I almost groaned as I took the "good fortune" out of my pocket and placed it before them.

"What a sweet beauty!" "What a splendid love of a watch to be sure!" were the enthusiastic exclamations that arose. "And look at that fine, blue long hand, tap-a, tap-a, tap-a, running round with such speed. What makes it shine so bright in the centre there? Is that a diamond? What a very small one to be sure! And they read on the dial: "Centre-Seconds Chronograph. Jacob Snail, London." "What's a chronograph?" "Oh," I answered, "It is a watch that you can stop and set going, whenever you please, ladies." "*Do* show us how that is done," chimed in chorus the sweet voices. I then put the stop on and brought the machinery to a standstill. "Now set it going." I took the stop off but, horrible to relate, there was no "go." I gave half a turn with my hand, still no motion. Then hastily, under the pretext of showing the "works," I opened the case, slily moving the balance with the end of a quill toothpick. Yet no motion. I then moved the "main wheel" as one of the ladies called it, in the opposite direction, when—"We're off," and off it went to my great joy. I need hardly say that the "pickle" was oozing out of my forehead hot and strong and rapid. The ladies took their departure, despite the entreaties of my wife—oh, unconsciously cruel wife!—to stay. When the street door closed upon them, I sank upon the sofa with a big gasp, saying that I was very tired, did not feel quite well, and should like my tea.

"Yes, dear," said my *far better* half, consolingly, "and a very nice tea I have for you. In addition to hot toast with dairy butter, which cousin Timothy has sent up from the farm, I have some potted relishes as well. So you can enjoy your tea comfortably, and then you may tell me all the news of the City."

The end of the day came with family gossip as it usually does, but my mind was inside those fly-wing gold cases, changing at times to the unpleasant words of Mr. Potence, until I went to bed. As I was always a riser in time not to be hurried over my breakfast, I found myself next morning, about half-past eight o'clock, confronted by the constitutional rasher and egg. Whilst the coffee was being poured out, I wound up my watch and slipped it into my pocket. Looking shortly afterwards to see "how goes the enemy," I found it dead, not a sign of life! I dare not do anything with it then, for my wife was present, and she *had eyes* "to spy into abuses." Some wives are living terrors in that style. There is nothing can miss them, from a fly on the table cleansing its wings, to the reflection of a "fearful conflagration" in the midnight sky many miles away. As soon as I could, after I got to the office, I was at my "work" with great savagery. I moved the balance backwards and forwards, but it was no good. I next turned it round as far as I thought was safe, when it "fiercely" rebounded and shivered again; and that was all that it would do. Oh, dear! I could get nothing but "jibbing" out of it.

In the evening I went round to my watchmaking friend, the one who so wished that he had had the making of it, and showed it to him. "Ah," said he, "I'll soon settle that." So he took off what he called the "cock," see-sawed the balance and hair-spring up and down, screwed all tight again, and away went the watch "like a good 'un." He then held it up to his ear, when he, too, see-sawed his head backwards and forwards, to right shoulder and left shoulder, then suddenly stopping short and listening with closed eyes, muttering to himself as if he was praying to the instrument. "Ah," he exclaimed, "*I* see what is the matter with her. There is nothing in this world that can tell you what ails her sooner than a watch; your wife would hardly know sooner."

"And what ails *her*?" I asked.

"Well, its not much use telling an outsider like you what it is, as you would not understand it, but she has got too much 'draw' on the pallets. You must leave her, as I shall have to take her down and go over her thoroughly." I did leave her, and called from time to time, but it took three weeks to get rid of the "draw." "I'll tell you what," said he, as I was paying the bill, "if I were you I would sell that watch to somebody who was emigrating into the bush somewhere. You might get a ten-pun-note for it, and they would not know any of its failings as we know them."

"But how could I sell a watch to any one when I knew that it was not good enough for me?"

"Oh, they don't care about that, providing they get it cheap enough. They will take it to Sydney, or Melbourne, or somewhere, and sell it to the niggers. Besides, when emigrants go into the bush, they put their watches away in the shanty. I had an uncle who was out there many years, and he told me that they never wore watches unless when they were at some great cattle-branding affair, or a settler's grand *Row-row*-palaver."

I came away making sure that the "draw" was right, and went on a journey. The second town that I stayed in I went down in the morning to "compare," as it is called, with the post-office clock, when I was stopped again. I had to come up on Saturday. I left the watch with my friend, and having no time to spare, I got to my ground again as soon as I could. When I returned, a bill awaited me that amounted to rather a "good lump." Amongst the items were "gold screws to the balance to weight it," "polishing the pallets," "trueing the 'scape," a new "fourth wheel and pinion," and "seeing to the motion work," or, as I was told, the wheels of the hands under the dial. Away I went, rejoicing in one sense, and with my purse sadly "slaughtered;" but, I was back again before many days had gone by. I noticed that the dial got very dirty, and that the bezzle wanted "seeing to." The bezzle was "seen to" by being "trued"—that "trueing" is one of the most fitting words, I think, in the whole vocabulary of watchmaking. The gold case-maker said that when he came to examine the bezzle he found that "trueing would be of very little use unless it was 'new-jointed.'" I think that I paid 7s. 6d. for that; but the joke was not yet ended, for when the bezzle went to the watchmaker it was found that the glass would not fit, so there was another 2s. for a new crystal! "You had better leave it with me for a day or two," said he, and I left it for a week. When I went back again, he told me that he had "topped" the 'scape-wheel, which he explained to mean that the ends of the 'scape-wheel teeth had been slightly shortened by grinding, so as to get what he called a better "drop." Next, the stop-work was very stiff, and that had, again, to be "seen to." That having been done, and the "draw," and "drop," and bezzle corrected, I took it that I was once more afloat—this time in fair sailing trim, and likely to remain so.

Several months had passed away without any mishap, when the watch began sensibly to loose. Another friend of mine, who lived a little way out of town, had for a "chum and neighbour" one of the best examiners in England; works for some of the great swell West End shops. If he had the watch, he would very soon put it to rights. None of your common Clerkenwell jobbers, but *a real tip-topper*. As I could not prevent the losing by the use of the regulator, the "real tip-topper" had the watch to examine it, as a special favour, on account of the link of mutual friendship. The "tip-topper" had it for a fortnight, when my friend brought it back with a bill of fifteen shillings attached to it. The "topper" had, it appeared by the bill, "freed" odds and ends here and there, given some "end-shakes" that were sadly wanted, and had "corrected" the grooves of the fusee. Considering the great favour that had been shown to me in looking at such a misbegotten "roasting-jack," the least that I could do was to pay the fifteen shillings without grumbling; and I did so pay them. I now reckoned up all these little disbursements one way and another, and as they were nearing to five pounds, I really began to think that the emigration proposal might have been the most *profitable* after all. I must have sent the watch to the auction-room at a very early stage of these mishaps, but a bulldog obstinacy had got hold of me, and I was determined to see the end of the affair one way or another; but that was not yet.

Some four months had passed along, and my troubles seemed to have all ended, when a friend asked me to go "a little way out," as an old friend of his had invited a few of them to a garden tea-party. I went, and in the course of conversation I learnt that the host was a retired escapement maker. Of course I had my watch, and of course he must have an inspection of it. He had, and like a child he immediately put it to his ear "to listen to what it says." "I hope," I added, "that the 'drop' and the 'draw' are all right." He gave me a startling look, "Oh yes," he replied, "but they *might be improved.*" I went on: "The end-shakes of both were freed only a short time ago, and, as I understand it, the fork of the lever has had its prongs sharpened fine, so that they will now stick into anything that comes in their way. Then the push-pin that I stop it with has been tightened up, as you can see by the "thumb-piece on the rim of the case." He looked at me with his mouth and eyes wide open, holding his breath for a moment; and then came such an outburst of laughter as made the very glass—I mean the tea cups—dance on the table. "Yes, yes," he said, "quite right, quite right. Freeing the end-shake of the drop, and the draw, and sharpening the prongs of the lever-fork are good, very good, and *very original,*" and he roared again.

"Do you know anything else that has been done to your watch?"

"The 'scape-wheel has been topped on the grindstone, and the bezzle has been knuckled to make it take a bigger crystal," I replied. Besides, the Topper, who works for the swell West End shops, looked to the odds-and-ends, and grooved the fusee up to the correct point, so that it will now go of itself almost."

"My dear sir," said he, severely stifling further laughter; "my dear sir, I have no doubt about what you say, but you speak in so droll a tone that that is what makes me laugh."

Well, droll or no droll, I was determined to let him see that I knew something about watchwork too. "The arc of the line of centres," I continued, "from which you get your lever resilience, as shown on the long spider-hand of the dial, gives you the synchronising property of the mainspring at once."

"True, true, he answered, I was not aware that you were so well acquainted with practical horology as you seem to be. We will now go into the garden and have a smoke."

I finished that part by telling him that the mean time screws in the great wheel of the balance were quite useless, because they screwed against nothing, and as the brass and steel rims were closely soldered together, they did not want to be kept up to the mark by any screws whatever.

"Say *fused,* my good sir, not soldered; the two metals are fused."

"Well, *fused,* if you like it better."

"It is more correct, my friend."

I went on: "Take the modulus of friction along the neutral axis of the fusee acting upon the vibrations of the balance-wheel spring, and you can get a unit of work between the mainspring and the vibrations."

"What answer did he make to that?" said one of our listeners.

"Oh, he told me that I had got quite out of his depth."

"About the only answer he could make," said another listener; "for you are altogether out of my depth, too, and out of all our depths, I should think."

Our friend continued: "He said, when I spoke about 'modulus,' that he was only a watchmaker, and having had thirty years of the trade, he had never heard such high-flown engineering language applied to it before. He then left the room to get some cigars, and as he passed out of the door we could hear that a sort of convulsive coughing laugh had come on. He told us afterwards in the garden that he was subject to fits of that kind when anything startling was told to him."

The present writer feels bound to say that the watchmaking portion of his audience had quite as much difficulty in keeping down the laughter as the escapement-maker seems to have had. After some questions almost bordering on the satirical, our friend went on:—

"We spent a very pleasant afternoon, and on coming away he begged particularly that I would leave the watch with him so that he might have a good look at it. It would be returned to me the day after to-morrow. I left it, and true to his promise it was returned with a note which said that he had reduced the pallet angles from twelve degrees to ten degrees, and that there would be far less "draw" now than before, and that the "drop" would be better. I thanked him by return of post, and said that from the ear test I thought that the impulse pallet wanted filing and stoning down a little so as to free the end-shake, whilst the locking pallet did not bite strongly enough across the line of centres. He wrote back to say that the proportion of lever to roller was three to one, and consequently ten degree angle pallets were the best, especially as he had got a sound guard-pin depth. I replied that *both* the guard-pins were deep enough before, as the broad end of the lever struck well against them from side to side. Still, I would have been pleased if he could have made them a little stronger—for that I liked to hear them distinctly, as the strength of the blow was a measure of the unity of the work in the life of the watch. I wanted to let him see that I had a scientific knowledge of the subject, and that he could not have it exactly *all* his own way. You see what I mean (laughter). When he told me about having reduced the pallet angle on the three to one lever and roller principle, I then saw what he meant when he said at his house that the drop and the draw might be improved. I further added that I thought that the mainspring ought to be *stack freed* for isochronisity. He wrote again, inviting me to spend another afternoon with him, when he would have a few old shop chums to meet me. His note thus ended: 'My dear sir, it may be no compliment to an analysing mind like yours to say that time-keeping science has lost much by your not having been brought up as a watchmaker. Nothing would give me greater pleasure than to hear you deliver a lecture upon the subject at the Horological Institute. I am an old member, and should you fall in with my suggestion, I will speak to the Council. I feel certain that your very advanced views would astonish the trade in a way that we can have no possible conception of. Think it over in your mind and let me know.' Well, that was complimentary, nevertheless. I never saw him again, as he went to reside with some relatives on a small property at Kenilworth, near Coventry, where he was born; yes, and where he died a few years ago."

(To be continued.)

Novel Machine for Demagnetising Watches.

WITH the extensive use of dynamo-electric machines there arises a difficulty, which is experienced by almost every one who comes into proximity with one of these machines; that is, the magnetization of one's watch so that its time-keeping qualities are seriously interfered with, or it stops altogether. Several methods of demagnetising watches have been proposed, some of which operate with a certain degree of success, but all are more or less troublesome and uncertain.

Mr. H. S. Maxim, the well-known mechanical and electrical engineer, of New York, has lately perfected a piece of apparatus, which is exceedingly simple and perfect in its action, and it may be used not only in watches and other small machinery affected by magnetism, but also on tools of any form or size. The device consists of a bar electro-magnet, mounted on a verticle spindle, so as to revolve endwise on a horizontal plane. It receives a current from a dynamo-electric machine, or galvanic battery, which is transmitted to the magnet-wires through springs bearing on the insulated collars above and below the magnet, these collars being connected with the terminals of the magnet wire. The frame supporting the magnet spindle is attached to the end of a bed piece, having on its upper surface ways for the carriage supporting the watch. This carriage is moved along on the bed piece by a screw, having at one end a crank, and at the other end a bevel wheel, which meshes into a pinion on the magnetic spindle.

The watch-holder is mounted on a hollow vertical spindle opposite the poles of the magnet, and takes motion from the screw through a bevel wheel fixed to its lower end, and driven by a pinion carried by the carriage, but rotated by the screw, the screw being slotted, and the pinion being splined for that purpose. The watch-holder is supported by a frame attached to the end of the hollow vertical spindle, and a small wheel is supported inside of the watch-holder frame by a fixed shaft running downward through the hollow spindle, and attached to the lower portion of the carriage.

The chuck, in which the watch is placed, is revolved by a belt passing over a pulley on the end of its shaft, under guide pulleys, and around the first wheel, so that as the watch-holder frame is revolved in a horizontal plane, the watch is revolved in an ever-changing vertical plane. The operation of demagnetising a watch is very easy. The watch is placed in the holder, and the carriage is moved up as near the electro-magnet as possible. The shear nut on the carriage is then brought into engagement with the screw, and the magnet is rotated rapidly, the watch at the same time receiving a compound rotary motion, which brings every side of the watch in opposition to the poles of the magnet. The electrical circuit is thus completed through the magnet, by means of the switch at the side of the bed-piece, and the rotary motion is continued until the carriage has reached the end of the screw remote from the magnet, when the electrical circuit is broken, and the work is completely done. It was a good fortune to witness this operation on a watch that was so thoroughly magnetised as to be incapable of making a single stroke of the escapement lever. When it was taken out of the machine, its motion was perfectly free and normal, and the most delicate tests failed to reveal a trace of magnetism.

The theory of the action of this machine seems to be, that the watch is subjected to rapid reversals of polarity in a gradually weakened magnetic field until the final reversals were practically *nil.*

Messrs. L. & A. Mathey, the well-known importers of fine watches, No. 16, Maiden Lane, New York, have the exclusive agency for this ingenious instrument. It may be seen in operation at their establishment, where watches may also be sent for demagnetization.—*Scientific American.*

A List of Watches, Watch Movements, Clocks, &c.

(Continued from page 43.)

8. A Small Square-Weight Balance Time-piece, hour hand only, silver dial, brass case, beautifully engraved and gilt. The subject being warriors on either side, and in the front a view of a town. At the top, death's head and hour glass, with the motto "Respice finem." It is in a good state of preservation, is an interesting specimen of the art, and considered unique.
Presented by George Atkins, Clerk of the Company.

9. A Very Small Horizontal Movement, formerly set in a ring.

10. A Very Small Vertical Movement. No fusee. Probably intended for a ring.

11. Part of an Old French Eight-day Watch. Movement with two barrels in gear by teeth on rim, fusee and chain, vertical escapement.
Presented by Charles Frodsham & Co., 1875.

12. An Early Specimen of Duplex Escapement.

13. A Very Fine Specimen of a Centre-seconds Lancashire Movement.
Presented by Messrs. F. B. Adams & Sons, 1848.

14. A Verticle Lancashire Movement.
Presented by Messrs. F. B. Adams & Sons.

15. A White Skin Case, with Silver Mounting. A very beautiful specimen of case jointing.
Presented by John Grant, 1874.

16. A Black Enamelled Case, ornamented.

17. Outer Case of a Watch, engraved and gilt with an enamel portrait of a lady.
Presented by Deputy S. E. Atkins, Clerk of the Company, 1873.

18. Two Antique Movements, with wheels, pivotted.
Found in the Company's chest.

19. Two Movements, with square-cut teeth. One a repeater, the other uncertain.

20. A Large Pocket Chronometer, Lancashire Movement.
Presented by F. B. Adams, July, 1869.

21. A Movement for a Small Pocket Chronometer.
Presented by F. B. Adams, July, 1869.

22. Two Skeleton Movements.
Presented by F. B. Adams, 1869.

23. An Ancient Movement, with tulip pillars.

24. An Ancient Movement, with tulip pillars.

25. Two Movements, by Ackers. 1778.

26. An Antique Movement, with tulip pillars.

27. An Antique Movement, with peculiar tulip pillars.

28. Regulator Pallets.
Presented by B. L. Vulliamy.

29. Nine Dials, some enamelled on gold.

30. An Enamelled Gold Dial, with seconds. Cost of manufacture, £1 17s. 0d.
Presented by J. B. Vulliamy, 1778.

31. A Small Antique Brequet Key.
Presented by Mr. Webster.

32. Several early Watch-keys

33. Two Gold Antique Watch-keys, one of them enamelled.
Presented by John Grant, 1875.

34. A rude specimen of a Wheel-cutting Machine, to be used in the vice.
Presented by George Philcox, 1875.

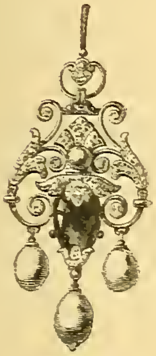
35. A plain Vertical Repeating Movement, of French manufacture, with enamel dial, chiefly remarkable for its diminutive proportions.
Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

36. A very thick Vertical Movement. The engraving of the cock and slide are of a very rude character, indicating an early period of manufacture.
Presented by Edward Streeter, 1875.

37. Four sets of Antique Watch Pillars, of Lancashire manufacture.
Presented by C. R. Harle, 1875.

(To be continued.)

MONTHLY SUPPLEMENT OF DESIGNS.



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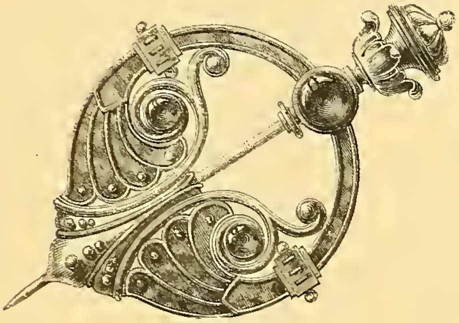

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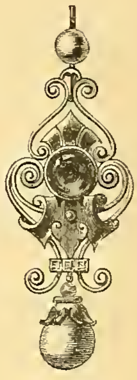

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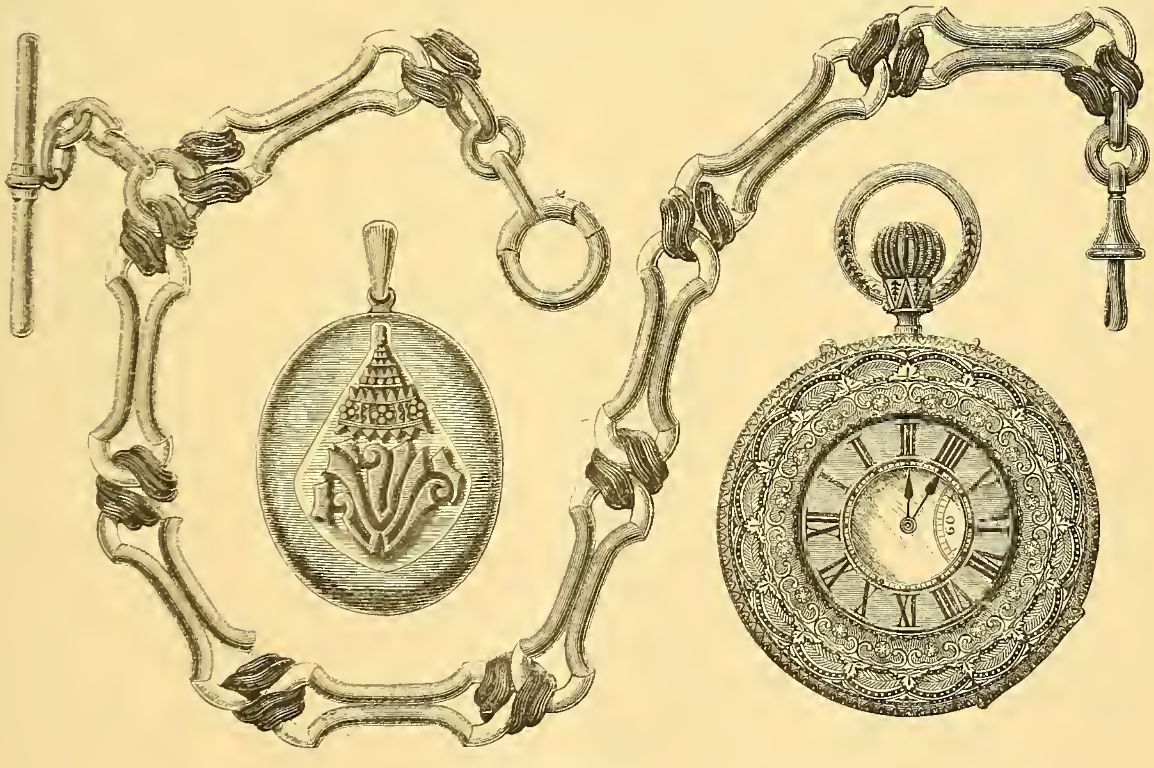

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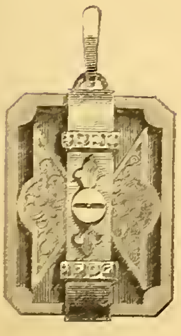

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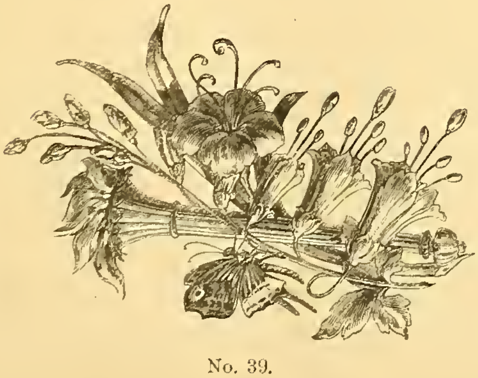

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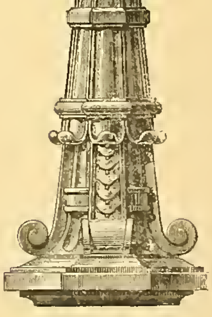

No. 40.

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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THE FUTURE OF THE ENGLISH WATCH TRADE.—We have much pleasure in informing our Readers that our able and esteemed correspondent, Mr. James U. Poole, has consented to contribute a series of papers on the above important subject.

No. 78.—Vol. VII.] NOVEMBER 5, 1881. [Subscription, 5s. per Annum. Post Free.

English Keyless Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Although this paper, like the last, is supposed to be devoted to a description of methods employed in winding fusee watches, I find it necessary to refer to a going barrel winding, which, at the time of its introduction, was known in the trade as "Phillips's"; because it was constructed on a principle which is embodied in two well-known fusee windings, viz., David Key's and V. Kullberg's.

In the plans to which I referred last month, the bevelled wheel had a "concentric" action, but in these three plans its action is "eccentric." In Mr. Phillips's arrangement, the centre-piece was fixed on the plate by a screw on the outside edge, so that it would swing freely either way. Another screw, the opposite side of the centre-piece, came through a notch in the plate, the body acting as a banking, while the head kept the wheel from lifting up. At one quarter of the centre-piece a pin was drilled, which came through another notch in the plate, and was acted upon by the return, or set hands spring. In the action of setting the hands, the bevelled wheel was thrown on one side into the set hands wheel, where, unfortunately, it would sometimes stick, and which I consider is the chief fault of the plan. The varying depth in the case pinion, caused by the swinging action of the wheel, cannot be as correct in principle as when the wheel turns round a fixed centre-piece. There is a lengthy description of Mr. Key's winding in the *Horological Journal* for September, 1869; it was patented in 1865. The arrangement appears to be exceedingly ingenious, but it has not been brought under my notice by workmen, probably on account of the patent, therefore I omit all reference to the details of its action.

Mr. Kullberg's winding is described in the *Journal* for April, 1869. Unlike the former, it was not patented, and has become the common property of the trade, although there are very few workmen who understand its principle. It is applied to specially-constructed left-handed movements, with solid backs, and great skill is required in doing the necessary turning-out in a proper manner. The cover (to a hunting case) and the bottom (to an open face) are important adjuncts to this arrangement, inasmuch as they shut the keyless wheels out of gear, and the button turns the crown or bevelled wheel freely either way. As a matter of fact, however, a bevelled wheel is not used in this plan; the case pinion has straight leaves, and acts in teeth underneath the crown wheel at right angles to it—or contrate teeth, as they are technically termed. On the cover or bottom of the case being opened, a turn of the button causes the set hands wheel to slip over the friction spring; this communicates leverage to a bar, and the crown wheel is thrown forward into the fusee wheel. It should be understood that this throwing-in gear is inseparable from all windings constructed on the friction principle, and there is an occasional liability of the teeth butting; this sometimes has the effect of leading a wearer to think that something is wrong, or that the watch is fully wound up when it is not.

The setting hands arrangement in Mr. Kullberg's winding is on the locking principle, and there are no outside push pieces projecting from the case. The same arrangement is used for open-face and hunters, consequently the latter have the seconds at the IX. I have only to add that at the exhibition of work at the Horological Institute, in November, 1873, the four competitors in the keyless department chose Mr. Kullberg's winding for their model, probably on account of there being no risk in so doing of infringing a patent. Some wearers object to the trouble of opening the bottom of a case to wind the watch up; and about the time that the last plan was brought forward, Mr. E. D. Johnson introduced a plan in which the winding wheels were thrown in gear by a push piece outside the case, which had to be pressed in during the operation of winding.

This was also adopted by another maker, a watch of whose construction came under my notice some fourteen years ago; and while I admit that the outside pieces are not altogether desirable, and that there is a slight difficulty in explaining the action to a customer, I also think that it cannot be surpassed for safety and certainty of action, and I would recommend it in preference to any other plan. It is equally applicable to hunters or open-face, but there is much less objection to opening the cover to a hunter than the bottom to an open-face, and I have frequently adopted a plan for the former, which for simplicity can be placed on the same level as going barrel windings. The idea was forced on me in consequence of having a keyless pocket chronometer on the "friction band" principle returned from South America for new cover and dial, the magnate for whom it was specially made having refused to have anything more to do with it. The friction band had been left too weak, and the consequence was, that after a short time it would not wind at all, although the fault was easily remedied here. Some forcible remarks, however, from the retailer, as to the injury done to his house, &c., acted as an additional impetus to devising something fresh.

The windings I prefer now to use for hunters are on this principle. When the cover is open, the case pinion is in gear with the fusee wheel, and revolves with it. On the cover being shut, a gold piece pushes a wheel under a cock out of gear, and thus entirely detaches the winding work. There is no succession of "throwings-in" during winding, and all risk of slipping is avoided. A minimum of cutting about and turning out the plate is required for this plan; but, simple as it appears at first sight, it requires to be very carefully constructed. Each depth must be as correct as if it were a fourth and 'scape, and the sectoring is all-important; for as there are four wheels employed in winding, any irregularity is at once made manifest. I consider that the number of badly designed and imperfectly constructed fusee windings which have been put into circulation, have had as much to do with bringing fusee watches into discredit as anything else, especially those which have been made to thin plates with very little room in the brass edges; and, in consequence, the lower fusee hole is very much distressed.

While on this point, I would say that I quite endorse the recent remarks of Mr. J. D. Fisher about the evils of soft fusee arbors and pinions, and fusee steels to keyless watches are sometimes softened by the keyless makers, in order to enable them to alter the screw taps to suit their wheels. This evil may be mitigated, as regards the lower pivot, by discarding the old-fashioned plan of pinning up the fusee, and using a loose collet, which is kept on by the keyless wheel. The pivot, as it forms part of this collet, can be left a proper temper, and as no space is taken up by a pin hole, the pivot may be all that much longer. These collets require the most careful management, as they have the power of throwing the entire fusee out of flat; but when once right, it is not liable to alteration, as in the case of a pinned-up fusee, which generally requires a fresh pin each time it is taken to pieces. Having written this much about fusee watches, I feel that many of your readers may think that the better way to get rid of all the complications connected with friction bands, springs, shutting-off pieces, &c., would be to cut the Gordian knot by abolishing fusees altogether. This has already been done in watches for the million—a fact which is frequently ignored by some who persistently attack our present system of manufacture; but high-class work is of so different a character, that I consider it stands out of the scope of argument.

As an illustration, I may say, that in certain foreign markets a watch without a chain would not be believed to be a genuine English production. It is not, therefore, the question as to whether the going barrel would not answer all the purposes of a fusee, but the commercial aspect has also to be considered. No doubt our American and Continental rivals would approve of an official condemnation of our fusee watch, but I would desire to see it retained as a speciality of the English trade in high-class work. In the present day, the keyless mechanism is such an important adjunct to a watch, that too much attention cannot be bestowed on its principles and construction; and I am pleased to see that the last number of this journal contains a valuable contribution from M. Grossmann on the subject, the continuation of which I am looking forward to with interest, as certain topics have been introduced on which I intended touching, but now prefer to leave to his able handling.

Possibly some discussion may arise out of the subject, which will give me another opportunity of addressing you.

I am, yours &c.,

33, Spencer Street, JAMES U. POOLE.
Clerkenwell.

"Truck" in the Watch Trade.

FROM THE "COVENTRY HERALD AND FREE PRESS," OF 21ST ULT.

Sir,—I wish to draw the attention of the watch trade to the system on which some manufacturers are carrying their business. I refer to the "truck" system. It is growing to such an extent that it is quite demoralising the workman, lowering the standard of the work generally, and preventing honest manufacturers from getting a fair profit on their goods.

I heard of a case lately where a manufacturer paid his workman in cloth, and the man, not having any use for it, offered it back to his master at a reduced price, to which the master objected, and offered half the price originally given, which the man accepted; but on being paid the half, was again compelled to take part of the amount out in shirts. Why do not a few of the respectable manufacturers meet and find some way of putting an end to this *illegal* way of doing business, either by exposure or some other means?

Yours truly,

A Workman.

[If some of our Coventry readers will supply us with the names, we shall be glad to give the manufacturers who make use of this abominable system a little gratuitous advertising.—Ed.]

Greenwich Chronometer Trials, 1881.

A reference to the above will be found in our "Trade Notes" last month, and we now give the rates of the five chronometers purchased by the Government, with the description of their construction as supplied by the makers. The trial commenced on January 15th, and terminated July 30th.

No. 3,972, by Kullberg, 105, Liverpool Road, N. (Reversed detent, with short spring).

No. 2,696, by Mercer, 161, Goswell Road, E.C. (Ordinary escapement with auxiliary to balance).

No. 5,763, by James Poole & Co., 33, Spencer Street, E.C. (Poole's auxiliary).

No. 3,720, by Edward & Sons, 1, Poultry E.C. (Improved ordinary balance).

No. 5,720, by James Poole & Co., 33, Spencer Street, E.C. (Poole's auxiliary Airy's Compensation).

The variations of these chronometers are as follows:—

Least weekly sum.	Temperature.	Greatest weekly sum.	Temperature.	Difference between the greatest & least.	Greatest difference between one week and the next.	Extremes of temperature during these weeks.
— 2·1	31° to 47° F	+ 6·3	60° to 73° F	8·4	2·3	39° to 54°
— 0·6	87° to 97° F	+ 8·7	87° to 103° F	9 3	5·4	39° to 106°
+ 2·8	41° to 51° F	+17·7	87° to 103° F	14·9	6·0	60° to 104°
— 2·2	69° to 105° F	+11·	46° to 55° F	13·2	7·3	39° to 106°
+ 8·1	41° to 51° F	+17·4	32° to 50° F	9·3	9·3	32° to 51°

The position of the above are determined by working out their "trial numbers," which are obtained by adding together the difference between the greatest and the least, and double the greatest difference between one week and the next: thus, the trial number of the first chronometer is 12s·10, obtained as described (8·4 + 2·3 + 2·3 = 12s·10.); and of the fifth, 27s 6, the mean of the total sums of the trial numbers to the first five being 22s·1.

It would appear that the first four chronometers were not fitted with the supplementary compensation arm, introduced by the late Astronomer Royal. On looking down the list, we find it described as being attached to 14 other instruments, commencing with the 9th and 10th, and descending to the 40th and 41st, there being in all 43 chronometers. Mr. Kullberg's chronometer has the smallest variation between one week and the next that has yet been recorded (2s·3), and, as last year, when his name appeared second, he has staked his reputation on the performance of one instrument. Messrs. Edward and Son's second one is 18th, with a trial number of 49s. 2, and Mr. Mercer's 19th, trial number 49s. 9. In order that our readers may be able to form an opinion of the progress (if any) made in the chronometrical art during the past five years, we have appended a list of the chronometers which have headed the Greenwich list since 1876. It shows how evenly balanced, on the whole, are the capabilities of the various makers.

Mean range of Temperature 35° to 140° F.		Greatest difference between one week and the next.	Trial number	Mean of sum of trial numbers of first five chronometers.
		s.	s.	s.
1876.	Graham & Parkes (Poole's auxiliary to balance)	2·9	12·8	18·2
1877.	Isaac (Original auxiliary to ordinary balance)	3·5	16·0	22·1
1878.	Pyott (Ordinary balance with slight addition). Airy's compensation.	5·5	22·0	25 6
1879.	Keys (Ordinary balance with slight alteration). Airy's compensation.	2·9	10·9	22·8
1880.	Cornell. Airy's compensation.	3·7	23·7	25·7

A range of temperature of 70° is a most severe trial for the instruments, and the precision attained is truly marvellous. At the Liverpool Observatory, where the compensation errors are tabulated for the information of captains in the Mercantile Marine, the range is only 30°, viz., 55° to 85°. Prior to 1840, the mean range of temperature at the Royal Observatory was only 35°, and since 1874 the trials in heat have been raised from 95° to the present high temperatures

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Hall-Marking Foreign-Made Watch Cases.

FROM THE "TIMES" OF 28TH ULT.

Sir,—May I be allowed to draw Mr. Chamberlain's attention, through the medium of the *Times*, to a point in connection with the above subject which does not appear to have been brought forward by the deputation of Liverpool watchcase makers who waited upon the right hon. gentleman yesterday at Liverpool?

At first sight it appears monstrous that foreign goods should legally be allowed to be stamped with marks which, by long usuage, are regarded as British trade-marks; but the fact is, that foreign watch cases, as such, are not entitled to be hall-marked, and a systematic form of very transparent evasion is practised in order to enable them to do so.

Prior to 1854, goods were compelled to be sent to the various assay offices by *bona fide* "workers," who were also restricted to the hall appointed for their own district; but section ii. 17 and 18 Vic., cap. 96, provided that "workers" and "dealers" might have their wares assayed and marked at any established assay office which they might select.

This at once gave the opportunity to the foreign manufacturers to obtain the British hall-marks; they made arrangements with agents here, who registered their addresses and initials at Goldsmiths' Hall or the other assay offices; and the officials have no legal right to refuse to mark goods so sent, although it is entirely within their knowledge that the law is being evaded.

It is impossible for English watch manufacturers to compete with goods which are procured abroad cheaper than is possible here, and the effect in the legitimate English trade is becoming most serious. Mr. Chamberlain truly says, however, that great difference of opinion exists on the point, the present system deriving much support from factors and many retailers; but this country has hitherto been supposed to be famed for its manufactures, and ought not to degenerate into a mere selling ground for foreign productions.

I am, &c.,

33, Spencer St., Clerkenwell. James U. Poole.

October 27.

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Jeweller's Postal Box.

Messrs. Lawrence Bros., Farringdon Street, London, have introduced an American novelty which will prove most acceptable to jewellers, watchmakers, and others, having goods to send by post. The "Postal Box," as this article is called, is a great improvement on the boxes hitherto in use; it is very light, and yet so strong, that one, of the size of a lucifer-box, may be stood upon without bending or breaking it. The corners are not tacked or glued, as usual, but neatly dovetailed, and the top is carefully let in and fastened to the box by elastic bands. It certainly needs only to be seen to meet with ready acceptance, the more so as the box is as cheap as it is handy and useful. It is made in any size, and sells to the trade from 1d. upwards. A paper-like covering, for printing or writing the addresses on, is also provided.

Gems and Jewels—in Relation to their Biblical History.

By J. W. Singer.

(*Continued from page* 60.)

THERE are no means of telling the sizes of the Breast-plate, but as the Plate was to be a "span the length of it, and a span the breadth thereof," it has been thought the stones were about an inch each in size: this would allow of the letters to be engraved, which in the case of the diamond, having the third place of the second row, had five letters for the Hebrew name of Zebulum. In addition to the twelve stones already mentioned there are several other precious stones spoken of in the original language, such as "Kadkod" and "Ekdoch," both of which signify the "Glowing of fire," and are translated carbuncle; and "Ramoth," a stone mentioned by Ezekiel and Job xxviii. 18, by some supposed to mean coral, and another stone called "Gabish," by some called a beryl, but all are of doubtful meaning.

In early times, from a feeling carried down by the idea of the twelve stones in the Breast-plate of the High Priest, these twelve stones came to be sacred to each month in the year, each one having its especial dedication, and together were called the Zodiac Stones. Thus, to make sure of having the right stone for each particular month, when worn as a charm, the twelve were mounted together as an amulet, in some form or other as a jewel, so that the wearer should be certain of having the right charm-stone upon every occasion. The same idea of the Romans dedicating a stone to each month was also carried on by the latter nations, and the same stones were then considered to symbolize the Twelve Apostles, as well as the twelve months of the year. In all these arrangements it will be seen that there is no mention of the diamond, nor in fact of any clear white stone, as formerly it was only *colour* that was sought for, as the sparkle of jewels is only a very modern invention. As it would be impossible to speak of all precious stones, I will confine my attention to the twelve mentioned in the Breast-plate of the High Priest, and in offering these few remarks they must kindly be accepted as only a few gossiping facts, picked up in my interesting business, and not as any pretentions knowledge on a subject that would exhaust any amount of learning, and is beyond me to explain. The directions for the Breast-plate are singularly clear and explicit—Exodus xxviii. 13. After giving the manner of making the ephod, with the two onyx stones to be worn on the shoulders of Aaron, and ouches of gold, and chains to the end, no doubt for holding the Breast-plate, it says: "And thou shalt make the Breast-plate of judgment with cunning work, after the work of the ephod thou shalt make it of gold, of blue, and of purple, and of scarlet, and of fine twisted linen shalt thou make it; four square it shall be, being doubled, and a span shall be the length thereof, and a span the breadth thereof; and thou shalt set it in settings of stones, even four rows of stones. The first row shall be a sardius, a topaz, and a carbuncle." The others following in the same rotation. The colours, blue, and purple, and scarlet, above, probably referred to enamel-work in the gold part of the plate.

The first stone is named the *Sardius*, and in the Hebrew was called "Odem," meaning red. At the present time a sard means all that part of an onyx of the Chalcedony family of quartz, of which all has been cut away, excepting the red part of the stone. It is supposed to have derived its name from the ancient Sardis, or from a Greek word meaning *flesh*, that being the colour of the stone. The Hebrew word, like the Arabic "Akik," may be rendered either as carnelian, or the ruby, or any precious stone of a red hue. In the modern name for the stone "Carnelian," the word comes from the Latin name for *raw flesh*, or "Carneus," and thus also meaning a red stone. Among the Hebrews and the Arabs carnelian was considered an important stone in physic, preserving life against the dangers of the plague, and they now employ it in the East for the stopping of hæmorrhage. Hebrew legends say that the blushing ruby became the symbolical representation of Rueben, who brought a blush upon himself by his irreverent conduct to his father.

The next stone is the *Topaz*, in the original called Pitdah. This stone derives its name from the Island of Topazion, from whence it was supposed to come, and said to be in the Red Sea. Its form of crystal is an eight-sided rhombic prism, of truncated form. Pliny said that the ancients had their stones from thence, but his account describes the chrysolite, a yellow kind of gem. They formerly ascribed to this stone that it discovered poison, when in contact with it, calmed the passions, and prevented bad dreams—its powers increasing and decreasing, according to the state of the moon. The Emperor Hadrian had a topaz seal with these lines:—

> "Natura deficit
> Fortuna mutatur
> Deus omnia cernit."

The pink topazes seen are only yellow ones changed by fire. The stone, when cut, is then closely enveloped in German tinder, firmly bound with fine wire. This, when burnt out, changes the yellow colour into a rose pink. Topaz came to be applied to any bright yellow hard stone that did not display a tinge of green, *that* being the mark of the chrysolite.

The third stone was a *Carbuncle*, in Hebrew, Baraketh; this term means a "*flashing stone*," derived from "Barak," lightning, and was translated also by the Greeks by a word that meant, literally, "thunderstone." In Isaiah liv. 12, two jewels are mentioned, both of which signify, by their names, Cadkod and Ekdoch, the "*glowing of fire*," and these are both here translated "*carbuncle*." "I will make thy windows of agates, and thy gates of carbuncles, and all thy borders of pleasant stones." The present meaning of the term carbuncle is that it is a garnet, cut in cabuchon form; that is, without facets, but a round convex top, like a drop of tallow. This stone, garnet, was called by the ancients, granatica, on account of its colour, which was like the seed of the pomegranate; and in the Talmud it is said that Noah had no other light in the Ark than that furnished by precious stones—Eastern legends saying that he suspended in the middle of the Ark a carbuncle to diffuse light.

No. 4.—In the second row was the *Emerald*. The Hebrew word "Nophek" signifies also carbuncle, or a stone that shines with the brilliancy of a "glowing coal." There is no stone the history of which is so disputed as this, or about which there is more obscurity. Some even say that it was not known before the discovery of America, from which place enormous quantities were then brought over, and the oldest emerald formerly known was one having the name of Pope Julius II. engraved on it, who lived about twenty years before the discovery by Columbus, until several others were lately found at Toledo, in an Eighth Century crown.

(*To be Continued.*)

Practical Instructions to Jewellers, Silversmiths, and Electroplaters.

By A. Roseleur.

(Specially Translated and Revised for this Journal.)

(*Continued from page* 56.)

Cold Silvering by Rubbing with the Thumb, a Cork, or a Brush.—The results are better than those by the whitening process, but not very durable: the method is useful to repair slight defects upon more durable silverings, and to produce mixtures of gold and silver, or gold upon slightly gilt objects, thus avoiding the use of resist varnishes. Make a paste by thoroughly grinding in a porcelain mortar, or with a muller, and, as far as practicable, not in the light:—

(1)	Water	3½ to 5 oz.
	White fused Nitrate of Silver, or preferably the Chloide	7 ,,
	Binoxalate of Potash	10½ ,,
	Bitartrate of Potash	10½ ,,
	Common Salt	15 ,,
	Sal Ammoniac	2¾ ,,
(2)	Chloride of Silver	3½ ,,
	Bitartrate of Potash	7 ,,
	Common Salt	10½ ,,

When finally pulverised in a porcelain mortar, triturate it under a muller upon a plate of ground glass, until there is no granular feeling. Keep the paste in a porcelain pot, or in a black glass vessel, to preserve it from the light, which decomposes it rapidly. When about to use it, add a little water, so as to form a thin paste, which is applied with a brush or pencil upon the cleansed articles of copper, or upon those gilt by dipping, or even upon those gilt by the battery, provided that the coating is thin enough to allow the copper to decompose the silver paste through the coat of gold: allow the paste to dry naturally, or with the aid of a gentle heat. The chemical reaction is more or less complete, according to the thickness of the gold deposit, and the dry paste is of a pink shade, or entirely green. The salts are removed by a thorough rinsing in cold water, and the silver appears with a fine frosted appearance, the brightness of which may be increased by a few seconds' immersion in a very diluted solution of sulphuric acid, or of cyanide of potassium. This silvering bears the action of the wire brush and of the burnishing tool very well; and it may also be oxidised. Should a first silvering not be found sufficiently durable after scratch-brushing, apply a second or a third coat. This silvering is not so adhering or white on pure copper as upon a gilt surface. For the reflectors of lanterns, the paste is rubbed upon the reflector with a fine linen pad; then, with another pad, a thin paste of Spanish white, or similar substance, is spread over the reflector, and allowed to dry. Rubbing with a fine and clean linen rag will restore the lustre and whiteness of the plated silver.

For Plated Silver Reflectors.—A bath made of water, 1¾ pints; nitrate of chloride of silver, 2oz.; cyanide of potassium, 10½ oz.; add sufficient Spanish white, or levigated chalk, in fine powder, to produce a thin paste, which is kept in a well-closed pot. This paste is spread by a brush, or a pad of old linen, all over the surface of the reflector, and allowed almost to dry, when it is briskly rubbed over by another clean dry rag of old linen.

Silvering by Dipping in a Warm Bath.—For small articles, a bath is made by dissolving in an enamelled cast-iron kettle, in two gallons of water, 17½ oz. of ordinary cyanide of potassium. Also dissolze 5¼ oz. of fused nitrate of silver in 1¾ pint of water, contained in a glass or porcelain vessel. The second solution is gradually poured into the first one. Stir with a glass rod. The white or greyish-white precipitate produced soon dissolves, and the remaining liquor is filtered, if a perfectly clear bath is desired. When brought to the boiling point, it will immediately silver the cleansed copper articles plunged into it. The objects must be quickly withdrawn. The silvering should immediately follow the cleansing, although the rinsings after each operation should be thorough and complete. This bright and light silvering is adapted for set jewellery, which cannot be scratch-brushed without flattening the clasps, and to which a bright lustre is absolutely necessary as a substitute for the foil of burnished silver placed under the precious stones of real jewellery. The employment of the solution of nitrate of binoxide of mercury is useless, and even injurious, for this bath. It is useless to keep up the strength of the solution by new additions of cyanide and silver salt; thus re-invigorated, it gives results far inferior to those of the former solution. The bath should, therefore, be washed out as long as the silvering is satisfactory, and, when exhausted, put away with the waste. With this process a battery and a soluble anode may be used to obtain a more durable deposit; but the operation is no longer a simple dipping, and properly belongs to electro-silvering by heat. A solution which, when boiling, produces a very fine silver coat, with a dead, or partly dead, lustre, upon cleansed coppers, is made by dissolving with the aid of heat, in a well-scoured copper kettle, distilled water, 9 pints; ferrocyanide of potassium, 21 oz.; carbonate of potash, 14 oz. When the liquid boils, add the well-washed chloride obtained from 1 oz. of pure silver This should boil for about half-an-hour, and be filtered before using; part of the silver deposits upon the copper kettle should be removed when a new bath is prepared. On account of this inconvenience, the process has been nearly abandoned, although the products are remarkably fine. All the dipping silvering baths, which contain a comparatively great excess of cyanide of potassium to the properties of the silver salt, will silver well copper articles perfectly cleansed, even in the cold; whereas, this property diminishes in proportion to the increase of the amount of silver in the bath, or with the decrease of the amount of cyanide. For small articles, partly copper and partly iron, such as those used for saddlery and carriage wares, a particular process of silvering is used. The bath is composed of:—

Water	9 pints.
Caustic Potash	6 oz.
Bicarbonate of Potash	3½ ,,
Cyanide of Potassium	2 ,,
Fused Nitrate of Silver	⅔ ,,

The cyanide, caustic potash, and bicarbonate, are dissolved in seven pints of water in an enamelled cast-iron kettle, then the remaining quart of water, in which the nitrate of silver has been separately dissolved, is added to the former solution. For the silvering operation, a certain quantity of articles are cleansed, thoroughly rinsed, and put into a small enamelled kettle. Enough of the silver bath is poured in to cover the articles entirely, and the whole is brought to a boil for a few seconds, and stirred with a wooden spatula. When the silvering appears satisfactory, the liquor employed is put with the saved waste; the same liquid is never used for two batches of articles. This process gives a somewhat durable silvering with a dead lustre, of a greyish white, which is increased in whiteness and brightness by soap and burnishing.

Silvering by Dipping in a Cold Bath.—As the bath is cold it is always ready for use, and the deposit is finer and more unalterable, because only chemically pure silver is deposited, without any mixture of subsalts. The bath is formed of bisulphite of soda, to which is added nitrate of silver, until it begins to be dissolved with difficulty. It is, therefore, with a double sulphite of soda and silver that the cold silvering by dipping is effected. Bisulphites of potash, ammonia, and other alkalies may be substituted for the bisulphite of soda, but the latter is to be preferred, because its preparation is cheaper, more easy, and better known.

(*To be continued.*)

American Competition.

WE give the following translation of an article in the *Schweizerische Uhrmacher Zeitung* of the 19th ult. The writer is a Swiss watchmaker, resident in the United States, and his object is to warn his countrymen against building too great hopes on the present increased importation of Swiss watches, as this greater demand is not due to a success of Swiss watches over American, but solely to the inability of American watch manufacturers to supply themselves all that their market requires.

"The progress of watch manufacturing in the United States," writes our authority, "is one of the marvels of the Nineteenth Century. New factories are springing up in many quarters, and the old ones are extending their premises and increasing their staff of workmen, and yet the supply is not up to the demand. The present production of the country is about 450,000 yearly, but, large as this number is, double the quantity could be disposed of if our manufacturers could supply them.

"It is not true that American watches have driven foreign ones completely from the market, but it is a fact that they compete successfully in whatever class of watch they do bring out. Our manufacturers have never attempted the production of complicated watches and chronometers: this branch is almost entirely in the hands of foreign makers, principally Swiss. Cheap watches, which may be bought at a price within reach of even people of slender means, are largely made there, but there is yet a cheaper sort of Swiss watches in our market which has been sold in great quantities these last few years, and which, in consequence of its inferior quality, does not directly compete with the home-made. The cases of these common watches are generally of similar nickel, and sometimes silver-plated or gilt. The principal consumers of this sort of watch are lotteries, bazaars, and auctioneers. I am quite right in saying that American watches have superseded the medium and better grades of foreign make, and that in the lowest and highest grades the other watch-making countries, principally Switzerland, still take first rank in this market. A few years ago, when the bad times were felt most keenly, American manufacturers lowered the prices about 40 per cent., and this gave a blow to the import trade, from which foreign manufacturers have not yet recovered. The greatest impulse was given to watch manufacturing by the Exhibition at Philadelphia, where the display of watches was so extensive that it astonished visitors from the Old and New World; and, it may be said, that few branches of industry created more interest. American watches received, however, the most important recommendation by Mr. Edward Farre-Perrel, the Swiss Commissioner at the Exhibition, who, on his return, delivered a speech remarkable for honesty and candour, and which brought him the maledictions of his countrymen and the thanks of the Americans.

"'Long,' said he, 'has America been the most important market for our watch industry,—our milch-cow, so to say; to-day we must prepare ourselves with all seriousness to do battle in a territory which we have commanded hitherto.'

"His words," continues our correspondent, "were prophetic in the highest degree, as the Swiss have continually struggled since they were uttered, but without making any advance. In 1864, Switzerland sent 169,000 watches to the United States; 1870, 330,000; 1872, 337,000: 1873, 204,000; 1874, 187,000: 1875, 134,000; 1876, 75,000. No wonder the Swiss got alarmed. A deficit of about 300,000 watches since 1872, coupled with the fact that the Americans had begun to send their productions to Europe, and already sold between 20,000 and 30,000 yearly in European markets, was enough to cause consternation. The open confession of the Swiss Commissioner, that certain kinds of American watches were superior to Swiss ones of the same price, was echoed all the world over. His speech was printed and spread broadcast, and to this day it is acknowledged that it was the best advertisement American watches ever had.

"The hard times also helped to diminish the importation of foreign watches, and within a few years it receded about 50 per cent. The consequence was, that a demand arose for American watches, principally of medium grades, which vastly exceeded the power of production, and at present several of our companies have orders for certain qualities which it will require months, if not years, to execute. It is stated that one factory is now 150,000 pieces in arrears. Last month the Waltham Watch Company turned out on an average 700 finished watches a day, and, although they have increased their hands to 1,800, they are unable to keep pace with incoming orders. These figures are startling, yet it can easily be foreseen that this immense concern alone will ere long send *a thousand watches daily* into the market: and it must not be forgotten that rival establishments are rising in all parts of the country. Switzerland profits from the circumstance that American manufacturers are unable to produce the low qualities in sufficient number, and if last year's imports are compared with those of the three or four previous years, it will be seen that they have doubled. As already mentioned, no attempt has yet been made to produce the highest class of work in this country, so that its importation will continue for many years to come, and the comparative cheapness of hand labour in Europe gives foreign manufacturers an advantage against which America will find it difficult to contend.

"The return of better times has, no doubt, had as much to do with the increased importation of Swiss watches as any other circumstance. The number of watches sent here from Switzerland last year is as high as it was in 1873, when the falling-off began. If this progress of the Swiss watch industry had been made at the expense of the American, our manufacturers must of course regret it; but as it has not interfered with them in any way, and has left them on a sounder basis than ever they were, they do not begrudge their foreign rivals the prospects of improved trade.

"The all-important question is, whether this state of things will last, and if the Swiss will in future always command the American market for lowest and best grades? It may be said that it is in the interests of American manufacturers to confine themselves to the class of watches they at present manufacture, so long as they are unable to meet the demand for them; but it is impossible to predict what American energy and enterprise may do in the future. Some of the machines now employed in American watch manufacture are truly wonderful. I will only mention a screw-cutting machine, which produces screws so fine that they can hardly be seen with the bare eye, no less than 150,000 screws being made from a single pound of wire. This machine finishes work much more perfect than could be obtained by the hand of man, and seven of them turn out 600,000 a month. Another machine supplies 14,000 pins daily for the dials. In 1860 the American production was 15,000; three years later 100,000, the military, then in the field, absorbing a great many: in 1876 it was 250,000; and last year nearly twice that number. The prices are a fourth lower now than they were in 1858 and 1859, the years in which the industry first gained a footing, in spite of higher-priced labour and material. The importation of English watches has practically ceased altogether."

Hall-marking Foreign Watch Cases.

IN the 26th ult., a deputation of watch-case makers waited upon the Right Hon. Joseph Chamberlain, President of the Board of Trade, at the Reform Club, Liverpool, for the purpose of laying before him certain grievances with reference to the hall-mark of watch-cases. The deputation was introduced by Col. A. H. Brown, M.P., who said the grievance the watch-case makers had to complain of was, that foreign-made watch-cases received the English hall-mark, and were then sold as English manufactured goods. The deputation was then introduced to Mr. Chamberlain, and Mr. Eagles stated their case at considerable length.

Mr. Chamberlain, in reply, said: I am glad to find that you altogether repudiate anything in the nature of protection for your manufactures. I am quite sure, from what I know of the watch trade, that you do not require protection; that you are perfectly able to hold your own against anything in in the nature of legitimate competition, and I am sure that the prosperity of the trade will be best achieved by retaining its present freedom. But if any alteration of the law is to be made, such as you suggest, I think we should have to go a little further in order to carry out your own notions, because it is a fact now that, although foreigners may send into the country watch cases which are not marked, no one can legally sell them in that condition. Unless we are to adopt the protective system, which you repudiate altogether, we should have to make it permissible for foreign watch-cases to be sold in this country without the hall-mark. Now, what was the original object of the hall-mark? Evidently it was to protect the buyer against the possibility of inferior metal being palmed off upon him. There is no idea that it was specially for the advantage of the trade, but it was to protect the buyer against fraud; and I confess it seems at first sight to me rather strange that the buyer of watches should be protected in a way in which no other buyer of any other article is protected. You have not got a Government stamp upon cotton, for instance, or any other goods but these which you manufacture, and I do not wonder that people at all events who have not followed out the practical working of this matter should be inclined to suggest, that probably the best course would be to abolish the hall-mark altogether as a compulsory thing, and to leave it open to the traders concerned to have their goods marked by a formal stamp being put upon them if they thought it desirable. That is a wide question which I think we need not further discuss, because I understand you to say, whatever may have been the original object of the hall-mark, the result has been now to give a sort of authenticity and character to English-made watches, which you think it very valuable and desirable to retain in the interests of the trade, independent altogether of the interests of the general public. I understand you to say, that when this mark is affixed to foreign watches, what you object to is not that the mark falsely represents the fact so far as it merely represents the quality of the metal, but that it is mistaken by the public as a guarantee of the origin of the manufacture; and that people are induced to buy watches made in America and Switzerland, under the belief that they are English watches, because they see the English mark upon them; and I suppose you would suggest that if these watches are to be marked at all, some additional or some special mark should be put upon them, so that they may be easily distinguished by the buyer from watches made in England.

Mr. Smith: That has been suggested in the Select Committee. I think Sir Edward Bates said it was no use. The letter "F" was suggested in addition to the hall-mark, but Sir E. Bates went with a watch-case with the letter "F" upon it, and he had the letter soldered up, and it proved that was of no use.

Mr. Chamberlain: Then your view is that the various halls should be prohibited by law from marking at all any watch-cases or goods of foreign origin?

Mr. Smith: Certainly.

Mr. Eagles: Only watch-cases.

Mr. Chamberlain: There is considerable difference of opinion upon the subject, because Sir H. Jackson, who came to see me on the subject, urged that this distinctive mark should be added, and that it would, in his opinion, satisfy all the legitimate demands of the trade. However, I have heard your views, and they shall have full consideration. I must point out that, although the report of the committee was in favour of some change, yet it was not unanimous, and I think some of the gentlemen you have named—Mr. Goucher, for instance—were opposed to the recommendations of the committee. There is a great deal of difficulty in carrying out either Sir H. Jackson's suggestions or yours. How are you to distinguish between foreign and English watch-cases? What is there in a watch-case that will enable the Goldsmiths' Company, for instance, to say with absolute certainty that it was not made in England? I have communicated with the Goldsmiths' Company, and others having similar duties, and I am bound to say that the information I have received from them is to the effect that there would be the greatest difficulty in the matter. Further, there is now a very large importation of foreign watch movements. You might have an English watch-case made in this country, and marked with the English mark, and yet the movement, upon which the value of the watch depends, would be a foreign movement, and then would happen what you now complain of—namely, that the buyer might be deceived into thinking he was buying an English when he was buying a foreign one. I state these things to show you that the matter has been considered, and at the same time to show that there are considerable practical difficulties. I shall be very glad indeed if you will consider these difficulties; and if you think it desirable to add anything to what you have said, you will communicate to me your views in writing, and give me the advantage of your practical experience. I think the question of Mr. M'Laren last session was answered by myself, and I think I said we had it then under consideration to consolidate and amend the laws relating to the marking of all gold and silver plate, but that I had not seen my way to make any progress in the matter. I am very sorry I must say it is difficult to look forward with anything like sanguine confidence to do more in the next session than we did in the past, and I must point out to you that this is only one of hundreds of other cases which show something like an absolute necessity for a revision of the rules of the House of Commons. You will never get your business attended to unless it is a political question. It is questions which are not political which suffer more than any others, and are more likely to be pushed out by the competition of urgent matters. But, I can assure you, you will never get any attention to this and other matters until there is such a change in the laws and regulations of the House of Commons as will enable us to deal with the enormous mass of business, the arrears of which are every year accumulating, and which, up to the present time, it is almost hopeless to attempt satisfactorily to dispose of.

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(Continued from page 61.)

128. This latter class, in the majority of cases, are executed with the so-called Breguet action; that is, they wind the spring when the knob is turned to the right, and perform a click action without any effect when the knob is turned the other way; thus affording the advantage that any inconsiderate effort for turning the knob the wrong way can not do harm to the mechanism. The Breguet click, however, is not an essential feature of this form of keyless mechanism.

129. The winding knob, in the majority of keyless watches, is connected by a square or other adjustment with the winding pinion, the arbor of which passes through the pendant, the pinion part being within the rim of the case. By this arrangement the barrel arbor on which the operation is to take place is situated vertically, while the pinion stands in a horizontal direction, and these two moving parts, therefore, must be connected by an angular gear. In most keyless watches this gear is composed of a straight pinion and a contrite or crown wheel. These, however, constitute a very imperfect transmission of force, because the teeth of the contrite wheel, being cut in the radial direction, can only agree in one point of the action with the direction of the pinion teeth, viz., when the side of the tooth is in the line of centres. During the part of the action which takes place before and after the line of centres, the pinion tooth works against the outer or inner edge of the wheel tooth, which is certainly not an advantage for both parts. The detrimental effects of a gear of this kind will be the more considerable with a pinion of low number, because its teeth lead through a more extended angle. Therefore it is necessary to slope off the wheel teeth inward and outward to lessen this defect as much as possible.

130. For these reasons it is preferable to employ a conical gear as offering the best conditions for a regular and smooth transmission of power, and for the durability of the parts. A conical pinion, too, can be executed much stronger than a straight one. There is, indeed, almost an impossibility of practically executing a conical wheel and pinion of perfectly theoretical shape of teeth; but in the way they are commonly made, they are quite fit for service, and far superior to the straight pinion and contrite wheel.

131. One of the best keyless mechanisms, on account of its simplicity and durability, has the following general features:

The barrel arbor has at its upper end the ordinary square, and on this square is adjusted a large wheel; as large, indeed, as the size of the watch allows, or, which is the same, nearly the size of the barrel. This wheel is in gear with another wheel of about two-thirds its size, which is concentrically connected with a conical wheel below the upper plate. This latter wheel is set in motion by a bevel pinion, the arbor of which extends through the pendant of the watch, and has a rifled button at its end outside of the pendant. One of the two flat wheels on the top of the upper plate has at the same time to perform the service of a ratchet, by means of a properly shaped click and spring. This is the fundamental principle of the oldest stem-winding watches, but many improvements have been made on it.

132. For the purpose of setting hands, devises of various kinds may be connected with the previously mentioned parts. The oldest plan of this kind was the following:—The winding pinion had a lengthwise motion, and upon pulling the knob a little out, the toothed part of the pinion came out of gear with the bevel or crown wheel, and by means of a lever, a small crown wheel was pushed in gear with the minute wheel, or another wheel connected with it. The small crown wheel was adjusted with a pipe unto the inner part of the axis of the winding pinion, either on a square or on the round axis having one side flatted about one-fourth of its thickness. The pipe of the wheel, in this case, had a steel pin screwed through its side so as to project a little in the hole, thereby getting sufficient hold on the flatted side of the axis to prevent the wheel from revolving on it, only allowing it a sliding movement in the direction of the pinion axis. (Fig. 38 shows the situation of the parts with the knob pulled out).

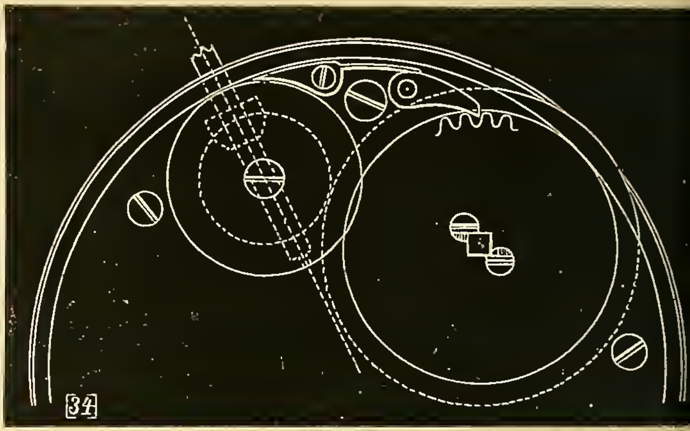

Fig. 37.

133. Another plan was as follows:—There was a small pinion adjusted to the inner round end of the winding pinion arbor, and freely turning on it. The minute wheel geared into a similar wheel, having another row of contrite or crown teeth, and these teeth were constantly in gear with the little pinion on the winding arbor, so that these two parts were following the movement of the motion work when the watch was going. This little pinion was kept in its position by a bridge, it had a small pipe projecting towards the end of the winding axis, and this pipe had two rectangular cuts across its face, forming thus four recesses, broad and deep enough to receive a pin fastened in a hole drilled across the extremity of the arbor. Thus, by pulling the knob and winding pinion out, the pin, when entered into one of the cross cuts, made the pinion follow its motion, and thus imparted the movement to the motion work. By pushing the knob back to its former position, the motion work became disconnected, and the winding action was in gear as before.

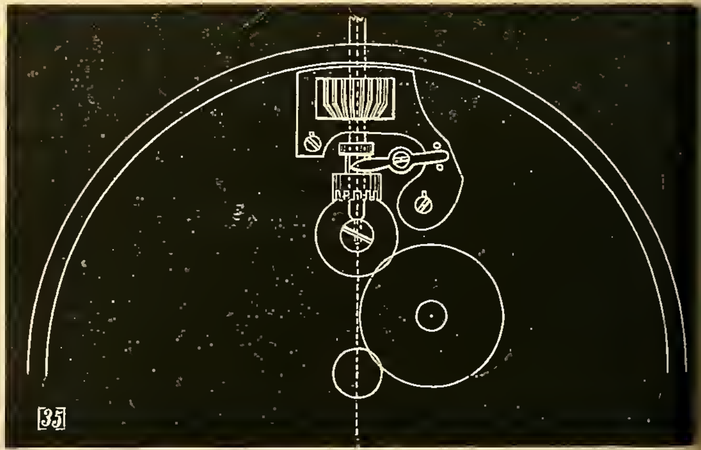

Fig. 38.

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134. This way of setting hands, certainly very simple and reliable, was found objectionable, because the knob, when pulled out for setting hands, was often left in that position by careless wearers, and the watch, having then to move also the winding pinion, with its considerable friction, was quite unable to perform its increased task, and stopped altogether. This was a drawback which has essentially produced mistrust against keyless watches, and finally it has led to dropping the device of pulling out the knob for setting hands.

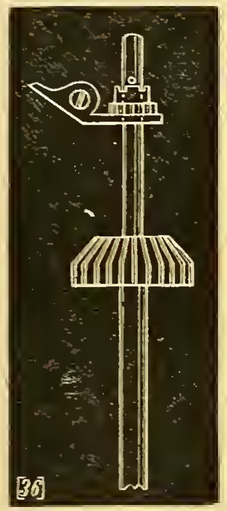

Fig. 36.

(*To be continued.*)

Trade Notes.

Dr. Kaylar gives the following recipe for a lacquer, which, when applied to a metallic surface, secures it the appearance of gold: To a shellac solution is added picric acid in sufficient quantity to change its colour, and half per cent. of boric acid

The Society of Arts, Geneva, at one of its latest sittings, has elected several honorary Associates of the Society. Among those who had this honour conferred on them, we are very pleased to notice the names of Messrs. V. Kullberg, chronometer maker, of London, and G. Rümker, astronomer and Director of the Maritime Observatory, Hamburg.

According to the *South Australian Register*, Mr. Chatwood has been successful against all-comers with his safes, the Juror's Report stating that they are "invulnerable to the attacks of fire or the burglar," and, as a consequence, was in three classes awarded first degree of merit, together with a special award of a gold medal for his exhibits as a whole, the display meeting with general admiration.

Mr. E. J. Watherston presided at a recent meeting of the Goldsmiths' and Silversmiths' Free Trade Association, held at 12, Pall Mall East, at which a committee was appointed to draw up a memorial to the Prime Minister, in favour of the total repeal of the duties upon gold and silver plate; and another to the Board of Trade, with reference to a reform of the hall-marking laws.

Mr. Friederich Lauterborn recommends the following process for manufacturing aluminum: Cryolite is boiled for some time in water, and the fluoride of sodium it contains will dissolve. The fluoride of alumina is then slowly heated with sulphate of lime, and changes into sulphate of alumina. The glowing product of the reaction is then poured into a vessel containing iron dust, or is left to cool, then pulverised and heated with iron. Metallic aluminum is the result.

The *Pawnbrokers' Gazette* warns the trade against a man of good appearance, age about forty or forty-five, who has left several duffing necklets about at different jewellers' and pawnbrokers.' He generally purchases a diamond ring, or a wedding-ring, and then wishes to part with a necklet, and, of course, draws a few pounds. The necklets are wove pattern, parts likely to be tested 15-carat gold, but the bulk of it is iron.

G. H. King, watchmaker, 177, Albany Street, Regent's Park, has been committed for trial on a charge of receiving some silver plate, well knowing it to be stolen. The articles are alleged to be part of a quantity of plate stolen from Miss Elizabeth Wildman, of 10, Cumberland Terrace, Regent's Park, by her footman, John Wood. As pawnbrokers are often unjustly abused in connection with stolen goods, we may mention that it is owing to the information of a pawnbroker that the robbery was discovered. Bail was refused.

Monsieur Saint-Loup, who is making some experiments upon the influence of atmospheric pressure upon the duration of pendulum oscillations, says, in *Comptes Rendus*, that there is an increase of about one-thirteenth of a second per day, for a fall of ten millimetres in the barometer. He does not attach much importance to this figure, regarding it merely as an indication of the order of magnitude of the disturbances; but it seems to show the importance of a correction for pressure in all calculations of exact time. Tresca states, that when the conference was held under the direction of Le Verrier, for the construction of three Parisian regulators of precision, one of the constructors, Mons. Redier, had fitted to the pendulum a metallic barometer, with an arm which was displaced so as to compensate the variations of retarding influence in the atmospheric pressure.

The attempts to manufacture watches in Russia, have not, according to the *Deutsche Handels Archiv*, proved a success. The factory, which was started about two years ago, in St. Petersburg, is already in liquidation. The whole Russian Empire is, therefore, still dependent on foreign countries for the supply of watches, and Switzerland commands the trade in watches almost exclusively. The two principal firms in this market are Messrs. Moser & Co., of Locle, and Bovet & Fol, Geneva; both of them have branches in Moscow. Germany (Black Forest and Leipzig) and Paris supply the clocks. Very few remontoirs are sold in comparison, as in the interior part of the country repairers for complicated watches are not obtainable. In Russia, with increased prosperity, there is a good future for the watch trade, as but a very small number of the sixty to seventy millions of the inhabitants of the interior possess watches. The Custom-house at Moscow received duty in 1880 for—

	Pieces.	Duty.	
Watch Movements	6,277	4,075	Roubles.
Gold and Gilt Watches	8,017	10,421	,,
Silver Watches	19,746	12,835	,,
Wooden Clocks, with Brass Works	20,944	8,653	,,
Turret Clocks	1	16	,,
Watch Parts	513pds.	1,642	,,

About 150 orchestriens, with an average price of 2 to 3,000 roubles, are imported every year from the Black Forest, but these instruments are now also manufactured in Moscow.

Mr. I. Herrmann's Introductory Address.

CHARTERHOUSE SCHOOL OF SCIENCE.

Session 1881-82.

GENTLEMEN,—According to the conditions of the announcement, to which your presence is the practical response, I am justified to assume that you are intending to become members of either one or the other of the classes which are to date their commencement from to-day and next Wednesday. Though at this moment you may be passive, I shall act upon this hypothesis, and address you as students, trusting that the transactions of this evening may so commend themselves to you, that they will generate a firm resolution to join the work, and with a will that ensures success.

The business before us this evening has reference to the work of the class that met here last session, as well as to the classes of the session to come. You are undoubtedly all aware that a class met here week by week all last winter. Nearly half of its members presented themselves for examination, and of those that did, fourth-fifths passed. Five of these obtained 1st class, namely, Messrs. Craighead, Hesk, Herrmann, Hill, and Wright. Mr. Wright received also a bronze medal and a prize of £2. Three obtained 2nd class, namely, Messrs. Aggett, Deed, and Gosling. Mr. Aggett's name appeared on the pass list in connection with the Cowper Street School, because he had taken a country situation before the examination, and came up to London on purpose for that event, and by some mistake presented himself there instead of with the class here.

The certificates and the prize obtained by these students will be presented at a meeting which the City and Guilds Institute has engaged to convene for this object some time in November. In reference to those that joined the class, but discontinued their attendance during the course, I would just say, that in some cases, it was the unavoidable result of circumstances. One member went to the Cape, others changed their situations; one member, I am told, was so unfortunate as to break his leg. Deducting these from the number that left, the ratio of constant attendants is decidedly over the average of those of similar classes. To those members whose names I have given, I beg to offer my thanks, and to express my appreciation of the way in which they have seconded my efforts; and to congratulate them on their success.

I mentioned at the first meeting, a year ago, and some of you may be otherwise aware, that in the past I worked hard to bring a certificate or diploma within the reach of the watch and clockmaker, believing that it would be a powerful auxiliary to individual effort, and a lever for the elevation in the social scale of the trade in general. What I failed to accomplish, in the face of open and disguised opposition, the City and Guilds Institute has irresistably carried, not only in the watch and clock trade, but in over thirty others. That such a powerful institution should take it up, is a proof of its beneficial object and value, and a practical censure on the opponents of it in days past. That the opposition still exists and is in power, is shown by the fact that two examinations have been held in watchmaking, and the names of thirteen watchmakers appeared on the pass list of the City and Guilds Institute, without ever receiving the slightest notice from the organ of the British Horological Institute. But it is this very opposition which gives me a strong faith in its ultimate benefit to the genuine section of the trade.

In London alone about two-thirds of those who keep watchmakers' shops are mere dummy watchmakers; they maintain their positions, not by what they are, but by what they pretend to be. It is from them, and the manufacturers whom they patronise, I experience the strongest opposition. The effect still exists, and I can have little doubt as to the cause. Seeing, however, the matter in the hands of so powerful an agency as the City and Guilds Institute, if the practical watchmaker is but alive to his own interests, and true to them, I have no fear for its ultimate popularity and triumph. I would just say, in passing, that it might be expedient to form a society of certificated watchmakers, or those certificated by the City and Guilds Institute in general; but, of course, that would be a business separate from the class we are commencing.

Seeing, then, that I take the views of the certificate which I do, and by reason of past endeavours being deeply interested in its success, you will understand and believe me when I say, that to me it is a great satisfaction to have been, to some extent, instrumental in assisting young men to it. I believe the members of the last class will give me credit for having done my best in their interest, and intending students may be assured that I shall do likewise in future.

Most of you may know that, like yourselves, I am engaged practically from morning until night, and hence, to undertake a work like this is not all play; still I take a great pleasure in it, and if I have as large a per centage of diligent students in the next session as I had in the past, I shall not regret it. Apart from the support that I have received from members of the class itself, I have specially to acknowledge that given me by the proprietor of the *Watchmaker, Jeweller, and Silversmith*. While prominent members of the trade were afraid to come here, lest they should give offence to the British Horological Institute, that gentleman has shown me frank recognition, and stood by me all through in the kindest way, which I appreciate very much. You are aware that Mr. Fischer very generously offered Saunier's Treatise as a prize for competition to the class, in addition to the offers of the City and Guilds Institute. Welcome as this offer was, its award presented some difficulties. Some time before the examination, I wrote to the Secretary of the City and Guilds Institute, acquainting them of this fact, and asking the Institute to award it. This he very courteously declined, for fear of establishing a precedent. There was, therefore, only one of three courses open, namely, either to hold a second examination, abandon the offer, or to make the award myself. The first was impracticable, because of the many difficulties it presented. The second would be a loss to the class, and very ungrateful to Mr. Fischer; hence, at that gentleman's suggestion, however reluctant, and with a feeling of delicacy, I felt compelled to undertake the task.

Mr. Fischer's object in offering this prize was to stimulate the efforts of the students; but if I failed by my decision to convey a sense of fairness and justice, that object would be lost, and I should convert the good Mr. Fischer intended into harm. This I am most anxious of avoiding, therefore will ask you to bear with me while I show you the process by which I arrived at my conclusions in this matter, hoping that if I fail to prove to you the wisdom of my decision, you will at least be impressed with my sincere desire to be just.

It is clear that my means of judging ended where that of the examiners commenced; hence, my work must end before theirs began. Here, then, I drew the line, and kept totally out of view the fact of an examination and its results, just as if there had not been one, or, I had made my award before. Again, the means I had at command for judging were conditions which were part of the students' engagement on entering the class; because I had stated at the meeting, last year, that students would be expected to do home work; therefore, those who did not do any, or very little, broke their part of the contract, and hence I considered them outside of the circle of legitimate competitors. These formed my preliminary considerations; I have reflected on them again and again. I think they are fair, and will apply in the future.

The contest lay, therefore, between very few, and the standard I applied was—the number of papers worked; their general merit and character in regard to attention, perseverance, and progress, with a consideration of the relative educational position of the competitors at the commencement of the class; and, after careful consideration, I arrived at the conclusion that the *Watchmaker, Jeweller, and Silversmith's* Prize is due to Thomas Daniel Wright. I beg specially to remind you that the prize Mr. Wright takes from the City and Guilds Institute formed no point whatever in my consideration, and is simply an incident. It is only due to others whom I call competitors to say, that there is much praise due for the way they have worked, and I am sorry that I cannot show my sense of it in an equally tangible manner.

Now, as to the work of the session to come. Starting with the matter of home work, I would strongly impress on you that I consider every student, by joining, engages himself to work the questions I shall give week by week, and that for more than one reason. In the last course this home work was, as a rule, badly attended to; I presume its object and importance was not seen through. I stated my reasons for it again and again. Now, the working of papers from week to week has, at least, a two-fold object. First, the exercise of it assists your progress materially. Let me impress the fact on your minds, that merely coming here week by week, if you do not reflect on what you hear, and exercise your reason upon it, will never carry you through the examination.

Secondly, it gives me the means of knowing how far I have been successful in conveying to you the truths I wish you to learn, and to supplement where I have failed; because, on looking over your papers week by week, I have the means of seeing how each student progresses, and can give such assistance as each student may require. If you reflect on my request, you will see that it can only be for your interest; because the only possible benefit I can derive in looking over a batch of papers weekly, is your good; for I can assure you my bump of morbid curiosity is not very great, and if it were, the task would soon stifle it. To explain to you the purpose of each item in the syllabus is an impossibility. You will have to learn to understand each one before you can see their importance and application; to do this is simply the work of the course, and therefore totally beyond the discourse of half-an-hour.

I may state, for the information of those intending to join the class, that they will possess some advantage over last year (that is the elementary), from the fact that now a simple condensed text is at hand in the pages of the *Watchmaker, Jeweller and Silversmith*, for those who like to avail themselves of it. In order to cover as much gronnd as possible, I shall not absolntely rehearse that again as a text, though in principle, by giving other and additional illustrations.

Let me assure you of this, that they are not merely selected by me as food for a hobby-horse; they are according to the programme of the City and Guilds Institute, which aims at the best effect for workmen; and let me also assure you, as a fellow-workman, that there is not one item needlessly introduced, which has not some application, and that there is not one that you will regret learning when once you have done so. Of course, some effort is required; but remember, that which costs nothing is worth nothing.

Apart from the utility which the tuition is to put at your disposal, you have the certificate in view. To lower the standard is to destroy its value; therefore the difficulties that may appear in the way of it are rather points of encouragement than discouragement to the diligent student; because the greater they are, the greater the credit and satisfaction it brings, and guarantee it gives. But, apart from this, the work, to those who enter into it heartily, will be a pleasure and not a dry task—a pleasure that has the seed of life, and not of decay, in itself; that is independent of secondary and external agency; a pleasure that brings no remorse, but satisfaction; that is second only to the study of nature's God.

It is necessary that you should be aware of my own conditions in relation to this class. All your fees are expended on the necessary outlay; I simply have to look to the grant which the City and Guilds of London Institute pays on the result of your examination; therefore, all those who did not pass the examination last year have received their instruction at my expense; hence, you will see that the engagement I expect you to enter into, to make twenty attendances and to present yourselves for examination, is only a reasonable condition. This forms another reason why you should work your questions. Nearly all who fail in this will fail in the examination as a rule. Occasionally a student will read up—I believe there was one case last year; but it is like catching a train after it has started, it is at most a great hazard. The student who leaves his work to the last as a rnle fails, because these examinations are not mere feats of memory, they act as a test of the understanding, and that, as a rule, requires time. The prizes are open to all students alike—that is to say, they are awarded according to the excellence of each paper; and if they all deserved it, they would all receive it.

An important alteration has been made in the programme of the Institute this year in regard to every trade, namely, the advanced grade has been taken away; whether this will make the elementary course harder, or the honours more easy, will be seen when the result of the next examination paper becomes known. You will see, according to my prospectus, that it is suggested to form a drawing-class. This is suggested by the fact that students who have no knowledge of drawing, find it a difficulty both to understand the idea represented by a diagram, or to convey their ideas by one; hence, it is to supply this want, and it would form an auxiliary to the other classes. There would be no grant available for such a class, hence the fees would range according to the number. Thus: suppose ten join, the fee for six months would be 15s. 6d.; if twenty join, 10s.; if forty join, 7s., finding their own materials.

Lectures on Watch and Clock Making.

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

Delivered at St. Thomas Charterhouse School by I. HERRMANN on Monday Evenings, from October 25th.*

(Continued from p. 63).

DEAD BEAT ESCAPEMENTS.

THE Graham clock escapement is generally understood to be implied by the above term, but really it is shared by all escapements where the escape-wheel remains in repose during the supplementary arc of the moderator. We will, however, take Clock Escapement first. Let A B (Fig. 44) represent a section of the periphery of an escape-wheel, C the centre of motion of the pallet, $a\ o$ the impulse plane of the pallet, and $o\ c\ d$ the locking, forming an arc concentric with C. That is, instead, $c\ n'$ (Fig. 42) being P c produced, it is here led off from o into an arc, whose radius is C o. It is evident from this, that if a tooth of the escape-wheel rests on point o, and the pallet continues its motion as indicated, the escape-wheel will remain in perfect repose, and hence, also, no amount of potential energy can have any effect in turning the pallet about its centre.

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Let ∠ *o* C *d* represent the supplementary angle of the moderator, then *d c o* represents the motion of the pallet under pressure of rotary energy of the escape-wheel. *c* C being the tangent to point *c* in the arc A B, represents also the direction of circumferencial force of the wheel in contact with the locking face at *c*, which passes through C, and, therefore, exerts a direct pressure on the centre of motion, and a normal pressure on *o c*. Now the work expended on friction during the supplementary arc = 2 *o d* × ·14, where the circumferencial force of the escape-wheel = 1, and ·14 = the co-efficient of friction, which would represent a force acting at point *c* on the pallet locking and at right angles to *c o*. But this is the resistance to the pallet movement acting at the end of a lever arm, which is the radius of the locking face of the pallet. But the pressure of the wheel is constant, and the arc varies as the radius; hence, by longer radius of pallet locking, we have the conditions of increased force acting on a longer lever arm and hence the resistance to the moderator during the supplementary arc, is synonymous to the conditions of moments in lever arms. This resistance has to be overcome by the kinetic energy* of the pendulum. Long and short pallets in the dead beat clock escapements have, therefore, to be decided by the length and mass of the pendulum. Increase of force in a recoil escapement, with a light pendulum, will cause it to trip along at a rapid pace, whereas in a dead beat escapement it will cause it to stop,† and thus, also, in recoil escapements the long arcs are performed quicker, and in a dead beat slower.

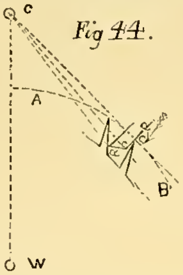
Fig 44.

Before we make a few practical applications we will notice the conditions of frictional resistance on pivots.

Let B D (Fig. 45) represent the circumference of a pivot, and C its centre. Let C *a* represent the direction of the pressure on the pivot, and the magnitude of the radius, and ∠ *b* C *a* = the limiting angle of resistance. Erect a perpendicular at *a*, meeting C *b* in *b*, then *d* C represents the frictional resistance on the pivot.

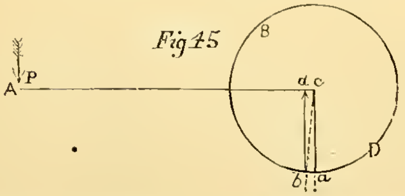
Fig 45

Let A C = the impulse radius of a pallet, P the impulse force, then moment about *c* = P × A *d*. It follows, therefore, that the resistance by friction on pivots is proportional to the radius × co-efficient of friction. Or let C = the centre of motion of a lever, let ⋇ = the weight and P the power. Then for power lost we have

$$\text{A C} : \text{C}\,d :: \text{P} : \divideontimes = \frac{\text{C}\,d \times \text{P}}{\text{A C}}$$

Likewise, it is evident that it reduces the impulse moment, and increases resistance during the supplementary arc in an inverse ratio to the impulse radius, and the kinetic energy of the pendulum.

PRACTICAL DEDUCTIONS AND APPLICATION.

We learn, then, from these facts, that we gain no increase of moment by a longer pallet radius; on the contrary, it is less, and in connection with the dead beat the longer the pallet radius the greater the resistance. But this resistance is to be considered in relation to the mass of the pendulum. Thus, a long pallet and a light pendulum would give bad time if it did go at all, and a short pallet and heavy pendulum would not afford means to neutralize any inequality in the train. It is, therefore, a question of harmony between the radius of impulse, impulse arc, impulse force and mass of the pendulum, and resistance on the pivots. We are, therefore, only at the commencement of the question. Time is a sum of which we only know the number of the factors, but not the magnitude of any one, and this question we must leave unanswered till a future period; still, we have shown something for practical purpose, and that ought to be a guide to a practical solution of this problem. It is evident, that there are less disturbing forces at work in a dead beat escapement than in a recoil escapement, and when the desirable harmony is obtained, it will be longer maintained in the former than in the latter. Still, it does not follow that a dead beat escapement will go better than a recoil, because it is a dead beat. The bastard escapement, known by the term "drum timepiece escapement," which is a terror to not a few watchmakers, affords a case in point. There we have the principle of dead beat connected with recoil, to neutralize the inequality of motive power, but the result often is, that the clock is dead beaten altogether.

The drum time-piece can, however, be made to go well enough. We will show the method, as it will assist in the workshop, and afford an illustration of the foregone principles.

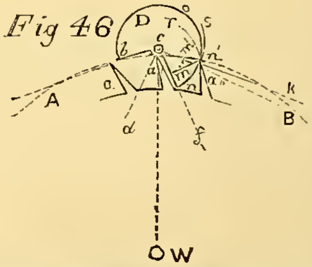
Fig 46

Let A B (Fig. 46) represent a section of the periphery of a drum time-piece escape-wheel, and *a a' a''* three teeth, and let D be the pallet, and *c* its centre. Let the impulse angle *b* C *d* equal the angle of rest *f* C *k*. Now, it is evident that on the return motion of the pallet, the whole section of the pallet *n n'* is under pressure of tooth *a''*, which pressure is supposed to neutralize any inequality in the motive power, which it does often in an undesirable manner.

Take any point *m*, in the line C *f*, and join *m n'*. Then ∠ *m* C *n* becomes an impulse angle, and *m n'* the driving plane. Let *n' o* represent an arc of a pallet concentric with C, then we have the principle of dead beat on the engaging pallet *m n'*, and recoil on the corresponding pallet. Suppose after this alteration the clock should gain when wound up, and lose when nearly down, then, by forming the locking arc of the pallet as shown in $n\,r$, so that point r lays nearer to the centre of motion, we have a recoil on the return motion of the pallet during the supplementary arc, in proportion to the magnitude of this arc. The supplementary arc is proportioned to the access of motive power, it is hastened during the impulse on the pallet b C, in its first half.

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* The work accumulated in a moving body.

† This fact has but lately been publicly disputed. But any one can try it for himself. Take off the pendulum of a Brocot or pin pallet escapement, and with the ordinary motive power it will go, but if extra force is applied to the third or escape-wheel it will refuse to go a single beat.

But the recoil of the escape-wheel, on the return motion, retards its velocity, and thus the inclination of $n'\,r$ affords the means of adjustment, so that approximately it maintains equal time during the stronger and weaker pull of the main spring. Again, should the reverse be the case, that is, should it lose during the first and gain during the latter, then by giving the locking the form $n\,s$ we obtain the recoil escapement, by which the longer arcs are quickened.

It is not only in drum time-pieces that we find this evil. I have seen English dials, and even bracket clocks of a superior class, which had scarce any impulse on the engaging pallet, hence it approximated to the conditions of the drum, and also proved nearly as troublesome until the alteration described above was effected.

To guard against a mistake here, it will be necessary to supplement this suggestion by a reference to Figs. 37 to 40. It will be seen, that in constant angles the force with which the pallet is turned about its centre is proportioned to the ratio of $d\,c$ to $d\,p$, $d\,q$, and $d\,r$, but $d\,c$ represents the angular motion of the wheel, and $d\,p$ that of the pallet; hence the magnitude of the pallet angle of impulse is independent of the angle of rotation of the escape-wheel during impulse, and *vice versa*; but it is evident that the smaller the rotary angle of the wheel, the smaller the power with which the pallet is turned about its centre, or the less its momentum.

Therefore, though both pallets may appear to have equal impulse angles, if the wheel angle of rotation is greater during one impulse than during the impulse contact on the other, the force communicated is in ratio of these angles.

The mechanical principle involved in the action of tooth a'' on the locking $n'\,r$ and $n'\,s$ (Fig. 46) will be pointed out when we treat the lever escapement, where it has its parallel.

Remark.—In the section on depthing we pointed out that an exception was claimed for the size of pinion on recoil escapements. This is due to the fact that the recoil of the escape-wheel reverses the conditions of wheel and pinion. That is, during impulse the wheels (train-wheels) are drivers, but immediately on its completion, the pinions become drivers. This fact certainly is in favour of the exception, but it does not warrant it. We have to remember, that when the pinion drives, it is the hard steel flank of the leaf, and during a very small angular motion, which can never have the evil consequences of a large angle of contact before the line of centres; indeed, it would have to be very large to meet the objection.

THE BROCOT, OR PIN PALLET ESCAPEMENT.

This escapement occupies, so to speak, neutral ground; that is, the inclination of the face of the teeth give the recoil; hence, it can be made with or without it, but it admits of no alteration when finished, that is, the recoil cannot be varied.

Let $a\ a'\ a''$ be three teeth of a pin pallet escape-wheel, and $b\ o$ the direction of the face of the tooth, then W $o\ b$ is its inclination with the radius; hence, during the supplementary arc, pallet p penetrates the periphery of the escape-wheel, and this arc of penetration forms a radius to the angle W $o\ b$, the chord of which is the measurement of recoil.

It will be of practical service to notice here a geometrical property, which belongs to all clock escapements with pallets spanning over a great number of teeth. It is a common process, when an escapement is deep or shallow, to alter the line of centres of wheel and pallets. This rule holds good where pallets enclose only a very few teeth, but in cases where they span nearly the diameter of the wheel, this method does not alter the depth but only the drop.

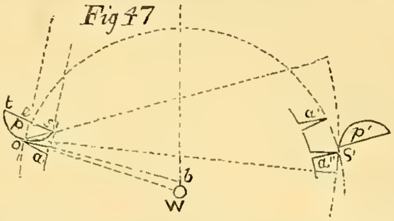


Fig 47

Thus, in Fig. 47, if we bring the centre of the pallet frame closer to W, we make the point o the centre of motion, because with tooth a resting on pallet p, the distance a to the centre of the pallet must remain the same; hence, practically, $p\,p'$ becomes the radius of this arc, and brings p' closer to a'' if we increase the line of centres, and closer to a' if we diminish it. Therefore, altering the line of centres has no effect on the depth, or angle of penetration of either pallet, at the moment when the tooth leaves the opposite one; this can only be effected by bringing $p\,p'$ closer together, if the depth is shallow, and further apart if it is deep.

THE PIN WHEEL ESCAPEMENT.

This escapement has been nearly exclusively used for turret clocks in England, but in modern ones it is generally superseded by Sir E. Becket's escapement, known by the term "Dennison gravity escapement."

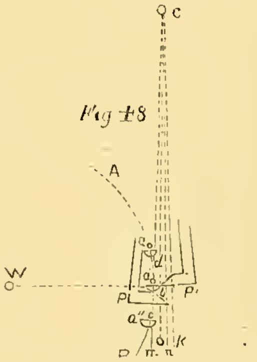


Fig 48

Fig. 48 shows the form mostly used. A B represents a section of the rim, with semi-circular pins set vertical in the plane of the wheel. $\angle\, m$ C n forms the impulse angle of pallet P, and o C K of pallet P'. $\angle\, n$ C o represents the opening of the pallets, and is determined by half the breadth of the pins, measured along the radius. The radius of the impulse planes forms, approximately, a tangent to the wheel radius of the tooth in contact, approximately, because the true tangent is a line bisecting $\angle\, n$ C o, and the point where it meets the radius lays at equal distance between the arc drawn through the delivery edge of pallet P', and locking edge of pallet P; therefore, half the angle n C o is the measure of departure of tangentical impulse on each pallet. Practically, therefore, the contact approximates in proportion to half the breadth of the pins, and nearer to the tangent taken throughout the impulse than any other escapement. We have here the same conditions as in a Graham escapement, with this exception, that we can take any point in the tangent to the wheel radius or pallet centre, and thus the pallet radius is independent of the wheel radius. This quantity has, however, to be in a certain ratio to the pendulum, as we have shown.

(*To be Continued*).

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

> "The great want in this country is a neat three-quarter plate lever watch at a low price, and this we have never been able to provide, so as to command the market, and keep out foreign competition."
>
> James U. Poole.

IT would be very difficult for Mr. Poole to describe more fully, and at the same time more briefly, the great want of the English watch trade. It would be still more difficult for Mr. Poole to suggest a line of conduct, or policy, that would more surely defeat the accomplishment of such a worthy object than in the one generally laid down in the letters he has addressed to the Editor of this Journal. Of late years it has been too frequently a characteristic of our business to be constantly enlarging upon our shortcomings, without taking adequate steps for their removal, and, in the absence of any effort of our own, we seem to take pleasure in severely criticising, instead of improving upon, the productions of foreign rivals. This unfair, unreal, un-English way of treating a difficulty, is by far the greatest misfortune that has befallen English horology during the present century, and as might be expected, those who have an interest in opposing the progress of our business, and not a few of them are our countrymen, have been careful to make the utmost of the opportunities offered by the gross neglect of those from whom we have a right to look for support. In this paper I propose to avoid, as far as possible, the beaten path in which we are walking, and which is evidently wanting in rectitude, and confine my remarks to those defects in which I think I see my way clear to suggest a substantial remedy; and if I do not succeed in improving the construction and making the going barrel watch all that you can desire, I shall at least have the satisfaction of knowing that I have made a right earnest effort in that direction.

By the word "Essay," I mean an attempt, an outline; not an exhaustive treatise, avoiding minor details, which are wearisome. By the term "low-priced watches," I mean *time-keepers, not toys.* Without saying it is not worth the attention of a Whitechapel or Birmingham toy-maker to produce a toy watch, clearly it is not the business to which we must direct our attention in Clerkenwell. I am persuaded that much of the extreme low-priced lever-work of Switzerland has materially helped to turn the balance of judgment in our favour, and there could not be a more fatal mistake than to recommend the making of a watch that is little short of a perpetual blister to both wearer and watchmaker. The necessity for a good, low-priced watch is so universally recognised, that it would be waste of space to advocate its manufacture. Need I say, that even errand-boys, labourers, porters, and mechanics are expected to be punctual in their engagements, and for them a watch is indispensable; and considering that so many thousand of such watches are required every year, it is not too much to hope that the market may be better supplied than it is at the present time. It is not only difficult, it is impossible, to say what may be accomplished in the future by means of equi-motive escapements, and electricity as a motor—two of the most alluring, but as yet undeveloped theories, so far as a pocket time-keeper is concerned; and for such we cannot wait.

In making a low-priced watch, we must secure every advantage that can be gained in fewness of parts and simplicity of construction, and we must alter our extravagant notions respecting beauty of finish. In dismissing this last point, let me speak freely and fully, and yet briefly.

Suppose a customer comes into your shop, and with unmistakeable emphasis, and certain well-defined lines of countenance, tells you that his watch varies considerably in various positions, and is thereby causing him great inconvenience. Tell me, do you immediately examine the balance of his watch, and see that it has been carefully *polished?* No, certainly not: but you will see whether it is carefully *poised.* Then I conclude that poiseing is of much more importance than polishing.

Again, suppose another customer comes into your shop, and tells you that his watch goes perfectly for a month or more, and then he suddenly finds it ten, twenty, or thirty minutes slow, yet he can never see it stop; tell me, in such a case, do you immediately get out your facing tools, that you may make the faces of the pinions perfect beauties, or do you sharpen your gravers, that you may cut the hollows deeper? Certainly not, for the account he has given points to a slight defect in the escapement; most likely the wheel and pallet depth is shallow; perhaps, from the 'scape wheel being out of truth, it misses the locking pallet only on one tooth; or a sharp edge may have been left by the pallet maker between the locking and impulse plane of the pallets, which has cut the 'scape teeth, and caused the bad results complained of. Correct this slight fault, and the performance of the watch will be irreproachable: and mark this, that it is the rarest thing in our business for customers to complain of the neglect of that which we fondly call "beauty of finish," and while there can be no doubt of the devotedness of those horologists who are careful not to neglect the anise, mint, and cumin, yet we may well suspect their sincerity and the soundness of their judgment when we see these things advocated and attended to, to the neglect of the weightier matters of the law, and for those watchmakers who are ignorant of the advantages of soundness in the construction of their work, assuredly it is not for them folly to be wise (see opposite view of this subject, page 20).

The models are based upon the calculation made on page 157, vol. 6 (see paragraph in small type). Their chief feature is an effort to combine the *strength, durability, and good time-keeping qualities* of our best English work, with the *beauties* of Switzerland, and the *sterling cheapness* of the American system of manufacture. I shall not give a detailed account of them, for this would occupy much space, and in so doing. I fear I should unduly impose myself upon the readers' consideration; for this reason I shall refer to them in future as little as possible, but shall be happy to show them privately or otherwise, at the office of this journal, to all parties interested in such work. What I have said of the word "Essay" is equally true of models; in fact, it is not possible to exhaust this subject. It is one, the importance of which is constantly recurring. No watch manufactory can be said to be complete in which modelling and designing is not a special department; and if I were competent, it would far exceed the limits of my leisure time to do all that is necessary in reconstruction for the making of "a *neat* three-quarter-plate lever watch."

It is the graceful conception and design of the exterior, rather than mechanical excellence and beauty of finish in the interior, that gives to Switzerland the pre-eminence and prominence in the market; and so long as they retain this captivating speciality, they may laugh, as merry Swiss boys only can laugh, at the puny efforts of Great Britain and the United States. From the American model we have little, perhaps nothing, to learn. But to the sterling characteristics enumerated we must add a sterling system of production; then, and only then, shall we be able to meet foreign competition, and supply that which is greatly needed just now—a reliable time-keeper, and yet a low-priced watch. So far as the making of a cheap watch is concerned, Europe to-day is at the feet of America.

I recollect to have read, I think in the history of the Crimean war, of a regiment of soldiers who, when they came close to the enemy, the officer in charge drew his sword, and, pointing to the valley of death, said, "That's the way, gentlemen." On hearing this the regiment remained unmoved: the cowardly and affected exhortation of their commander had no effect. A brother officer of inferior rank stood by, saw the danger of delay, and deliberately walked into the thick of the battle, saying, "Now, lads, follow me." This manly speech moved the entire regiment, and speedily turned into a victory what must have ended in an inglorious defeat. It is the character of this officer of inferior rank that I earnestly covet for both models and essay. No effort on my part shall be spared to give an incentive to exertion for the accomplishment of that to which Mr. Poole only points.

It remains only to consider Construction and Manufacture.

RICHARD WHITTAKER.

(To be continued.)

A List of Watches, Watch Movements, Clocks, &c.

(Continued from page 68.)

Anogent Angtier.

38. A Silver-gilt Oval Hunting Watch, silver engraved edge. Made previous to the introduction of chains; gilt and engraved allegorical dial.

Presented by Charles Thistleton, of Whitehall Place.

Arnold, John.

39. A fine old specimen of a Pocket Chronometer, in silver-gilt case. Pivot detent escapement, with figure S compensation pieces, carrying weights in direct line to centre of balance, re-spring by Charles Frodsham, for the purpose of testing the compensation. No. 28.

Presented by Charles Frodsham & Co., 1875.

40. Specimen of a one-day Marine Chronometer, in octagon case, enamel dial, epicycloidal escape-wheel, adjusting balance spring stud. No. 14.

Presented by Charles Frodsham & Co., 1875.

41. A fine specimen of a two-day Marine Chronometer, in octagon case, with glass bottom and medallions at side, enamel dial, epicycloidal escape-wheel movement jewelled to the centre wheel, gold balance spring. No. $\frac{101}{191}$.

Presented by Charles Frodsham & Co., 1875.

Atkins, Francis.

Born in 1730; apprenticed to Joshua Hassell, December 1st, 1746; admitted to the Freedom, April 2nd, 1759; to the Livery, December 4th, 1769; chosen on the Court of Assistants, April 5, 1773; served the office of Warden, 1777-79; chosen Master, September 29th, 1780; elected Clerk of the Company, December 5th, 1785; succeeded, upon his decease, by his son, George Atkins, December 22nd, 1809.

42. Plain Vertical Movement. No. 3,659.

Presented by his grandson, S. E. Atkins, 1875.

Baron, Jean, Etrecht.

43. Vertical Movement, with pierced pillars, and enamel dial.

Presented by Edward Streeter, 1875.

Barronneau, L., Paris.

44. French Vertical Movement, without dial, made previous to the introduction of chains, hour-wheel turned by lanthorn pinion on fusee arbor.

Presented by B. L. Vulliamy, 1816.

Barrow, Nathaniel, Londini.

Apprenticed to the Company, 26th January, 1653; made Free, 28th January, 1660; chosen to the office of Warden, 14th October, 1685; Master, 29th September, 1689.

45. Silver double-case Astronomical Watch, denotes the hours, days of the week, months of the year, equation, moon's age, &c.

46. Metal double-case Repeating Watch, with enamel dial, the inner case pierced and gilt.

Presented by Joseph Fenn, 1862.

Barthet, E. A., Marseille.

47. Thirty-hour Marine Chronometer, of French manufacture. Name, Barthet, No. 10. A very fine specimen of highly finished work, has a beautiful proportioned barrel pendulum spring. The hours, minutes, and seconds are shown on distinct circles. It has also a metallic thermometer, the arrangements for which are between the dial and pillar-plate, the scale, Reaumer's, being indicated on the dial plate by a delicate band traversing about 150 degrees.

This chronometer was picked up at sea, from an abandoned vessel, by the late Sir William Walker, in the year 1846, when in command of the "Monarch," belonging to Messrs. Green, of Blackwall, and was purchased of him for fifteen pounds, by Messrs. Brockbank and Atkins.

Presented by Deputy S. E. Atkins, Clerk of that Company, sole representative of that firm, 1875.

Betts, Samuel, Londini.

Apprenticed to Samuel Davis, for Job Betts, 7th October, 1675; made Free of the Company, 7th October, 1682.

48. Green Enamelled Gold Watch (case damaged), case enamelled, with landscapes inside, green enamelled dial, hour hand only.

Purchased by the Company, 1816.

Binks.

49. Gilt Lever Movement, jewelled throughout, capped, No. 759.

Presented by F. B. Adams, 1869.

Bizot, à Paris.

50. A large thick Vertical Movement, with rack and pinion, regulator cock pierced and engraved.

Presented by B. L. Vulliamy, 1849.

Barrett, George, Stowmarket.

51. Plain Vertical Movement, with square pillars, enamel dial. The cock and dial elaborately pierced and engraved. No. 120.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Boys, A., and Duduict, Jacques.

52. An Ancient Clock Watch, striking on a bell, silver hour circle, hour hand only, the case gilt, pierced, and engraved. It had originally catgut, and without pendulum spring, which has since been added, gilt engraved face; subject: Actæon. "He saw Diana and her attendants bathing near Gargaphia, and for his rashness in approaching the place, the goddess sprinkled water over him, and he was changed into a stag and devoured by his own dogs."—*Lempriere.*

Presented by C. R. Fletcher Lutwidge, Esq., Holmrook Hall, Carnforth, through W. Wing, October, 1874.

Bradford, Strand.

53. Silver pair case Open-face Watch, with enamal dial. No. 115.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Bradley, Langley, London, N. R. O.

Apprenticed to Joseph Wise, 24th February, 1687; made Free of the Company, 14th February, 1694; served the office of Warden, 1724-26; Master, 1726.

54. Repeating Movement, with Stockden motion.

Bréguet (Abraham Louis).

A small movement, injured by fire.

Presented by B. L. Vulliamy, 1849.

Bréguet (Abraham Louis).

56. Movement only, single hand, ruby cylinder, parachute and compensation, winds up from the centre. No. 1,603.

Sold to Mr. Menard by the above firm in 1806. Cost 840 francs. Purchased by the Company for £6 10s., in 1853.

Bréguet à Paris.

57. A Gold Open-face Minute Repeating Watch, with Stockden Motion. A very beautiful specimen. No 128.

Presented by F. B. Adams, 1870.

(*To be Continued.*)

Bronzes.

By C. D. E. Fortnum, F.S.A.

Continued from page 58.

DONATO, the son of Nicolo di Betto Bardi, born at Florence in 1386, and generally known as Donatello, was perhaps the greatest sculptor of the revival, until the giant art of Michel Angelo arose, subduing all. Ghiberti, admirable as he was, could not advance beyond the pictorial and miniature representation of histories beautifully told, and accompanied by an execution of the ornamental details worthy of his own, the goldsmith's, highly-developed art. In larger subjects he was deficient, nor did he ever work in marble; but Donatello, while able to execute the most minute elaboration with loving care on both materials, could rise far higher in conception and creation. Since the fall of the Eastern and Western Empires, no equestrian statue of life or heroic size had been attempted till Donatello modelled and cast the Gattamelater. As a lad he studied under Bieci di Lorenzo, and was protected and lodged by Ruberto Martelli, the banker, his patron and friend. He travelled to Rome with his friendly critic and rival, Brunelleschi, to study antique sculpture and architecture, returning after two or three years. His earliest important works as a sculptor are "The Annunciation," a *rilievo* in stone, at Sta-Croce—a work of great refinement—and the statues of St. Peter and St. Mark, at Or San Michele; and his most highly-elaborated work, "The Martelli Mirror," now in the South Kensington Museum, is fully described in the large catalogue. Perhaps his last work, and inferior, is the statue of St. Louis, of Toulouse, over the portal of Sta-Croce, in Florence. Befriended by Cosmo to the last, but broken in health and latterly paralysed, Donatello, who, perhaps, may be termed the Phidias of the revival, died in 1466, aged eighty.

Less picturesque than Ghiberti in his representation of subjects in *relievo*, we have in Donatello a greater artist, capable of mastering works of higher import and in a manner which had not hitherto been equalled. His statue of St. George is worthy to rank in grandeur of conception with the best efforts of any school or time; while the minute care and finish which he could bestow is exemplified in "The Martelli Mirror." The South Kensington Museum is rich in marble works by this great Master; "The Deposition" (No. 7577), and "The Charge to Peter" (No. 7629), are fine illustrations of his pathos and power of naturalistic representation, the latter being one of his finest works in that low *rilievo* known as *stiacciato*, in the use of which he was unrivalled. If Ghiberti was a "painter in bronze," surely Donato may be termed an "etcher in marble."

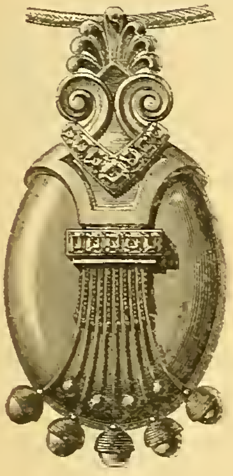
Simone, a Florentine of uncertain patronymic, who was engaged at Rome upon the bronze tomb of Pope Martin V, was also occupied there assisting, or assisted by, Antonio Averulino, known as Filarete, in making the bronze doors of St. Peter's, which were executed about 1439. On this work we see the impress of a school whose master spirit is no longer there. Events of the life of Pope Eugenius IV. are represented in panels—martyrdoms of some of the Apostles, scenes from the life of our Saviour, &c.; while among the ornaments upon the border are introduced such subjects from the antique as Jupiter and Ganymede, Leda and the Swan, &c., in violation of all propriety; and in the lower stile, inside, Filarete has represented himself and his workmen going on a frolicsome jaunt with a well-laden donkey. At Prato, the beautiful lattice work in bronze, teeming with human and animal life among foliage, &c., made for the chapel of the Cintola in the Cathedral, is a work of this school, which has been doubtfully attributed to Simone, who also worked in marble at St. Francesco in Rimini. Dello Delli, who was born about 1404, accompanied his outlawed father, Niccolo, to Siena, and there, in the year 1425, made a large figure in bronze to strike the hours on a bell, which was placed on the tower of the Pallazzo Publico.

To preserve the sequence of Florentine bronze sculpture with greater regularity, we will, before considering the works of Donatello's great pupil, Verrocchio, and other great bronzists of his time, refer to one who for the most part was independent of the influence, as he was also of the more picturesque tendencies of Ghiberti, and seems rather to have modelled under the guidance of the antique standard. He was Luca della Robbia, whose earlier sculptures were executed in marble (among which the justly celebrated group of singing boys is an admirable example), but who is more universally known as the modeller of those finer productions in glazed terra-cotta, with which his name has become inseparably associated.

Luca Della Robbia (1400-1482) executed one notable work in bronze, the doors leading into the older sacristy of the Duomo at Florence, of which there are casts at South Kensington. This is a fine work; each valve divided into five square panels, bearing subjects in *rilievo*, and representing seated figures of saints, &c., attended by angels; on the surrounding stile, at each angle of the panels, is a projecting head in full relief. The two upper panels represent, on the one the Virgin and child, with two angels; on the other, St. John the Baptist, similarly attended; below these are the four Evangelists, and again, beneath are the four doctors of the church. Dignity and thoughtful repose are admirably expressed in these noble figures and their accompanying attendant angels. The group of the Virgin and child is a most graceful composition. The projecting heads, representing personages of both sexes and every age, are effective and individually excellent; and, indeed, the general effect of proportion and well-balanced ornamentation on the whole work, though less picturesque in treatment, and more strictly observant of the rules by which sculptured bas-relief should be guided, may well compare with the more composite designs and not more excellent modelling of his great and successful rival, Lorenzo Ghiberti. These doors were begun by Luca in 1445. Their execution had been entrusted to the combined care of Michelozzo, Maso di Tolomeo, and Luca. After the death of Massacio, Giovanni di Bartolmeo was commissioned to polish and prepare the framing and hanging, which was completed in December, 1463. Michelozzo was then absent, and Luca was commissioned to finish the door. On examination of the various subjects, no difference can be traced in the composition or manner of handling, and it is but reasonable to conclude that the entire modelling was the work of Luca della Robbia's own hand. We have dwelt rather fully upon the consideration of this grand door, considering it, as we do, so fine a model, and as the only work in bronze by this admirable sculptor.

(*To be Continued.*)

MONTHLY SUPPLEMENT OF DESIGNS.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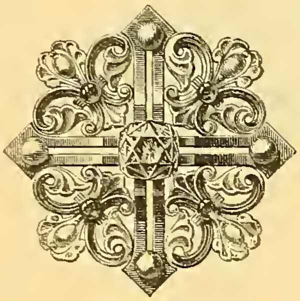
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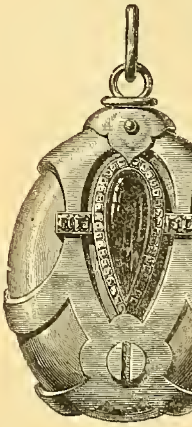
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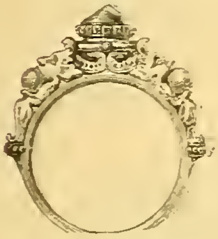
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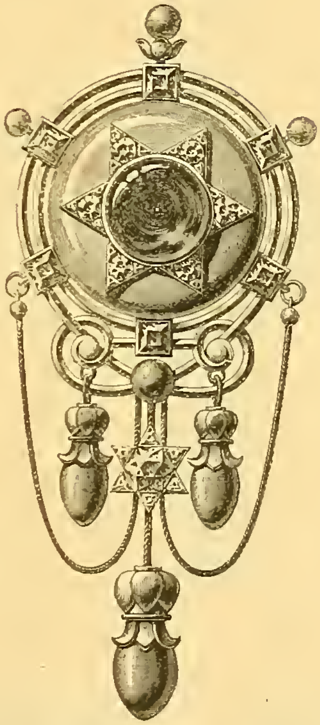
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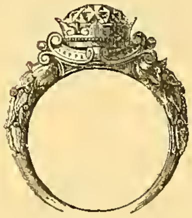
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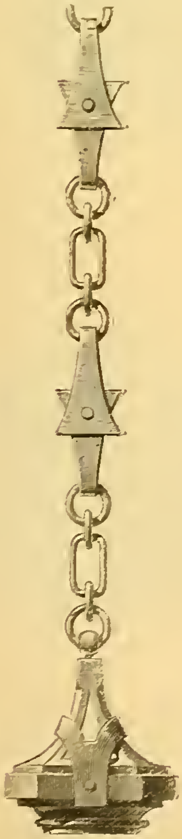
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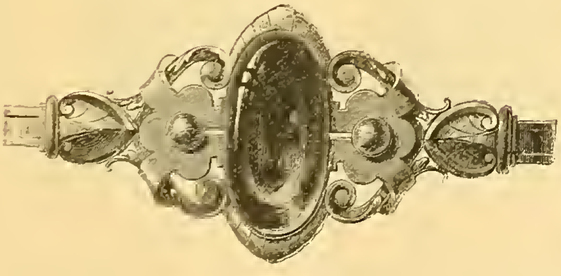
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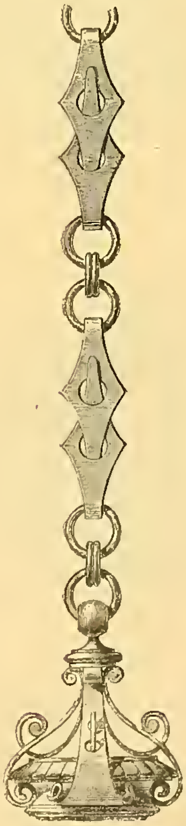
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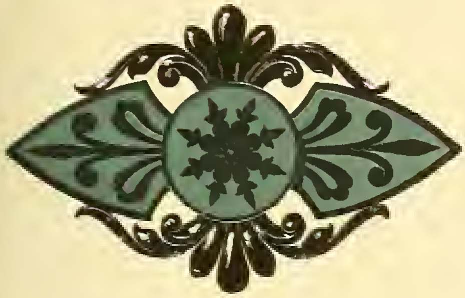
HIRST'S PATENT JET MOSAICS.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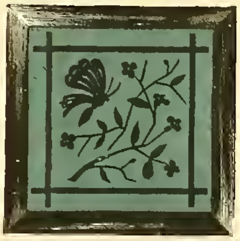
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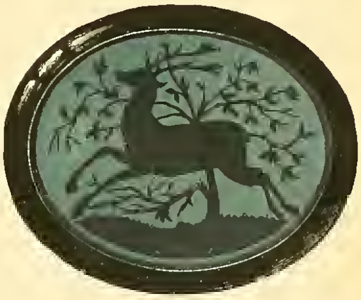
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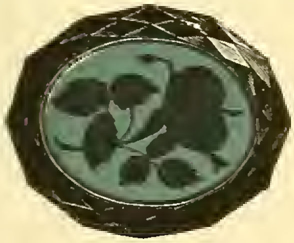
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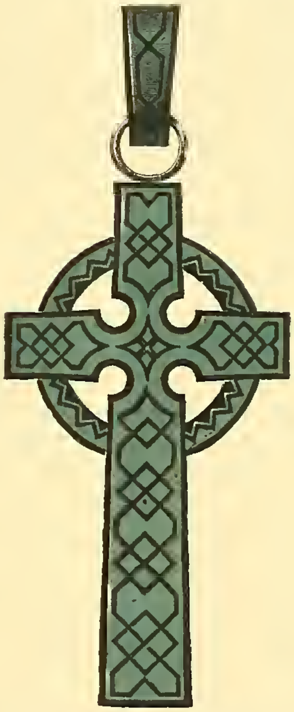
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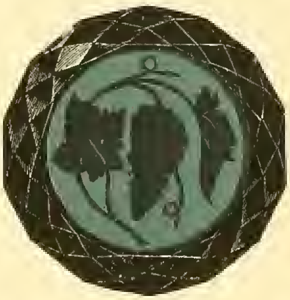
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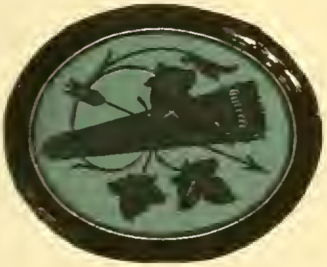
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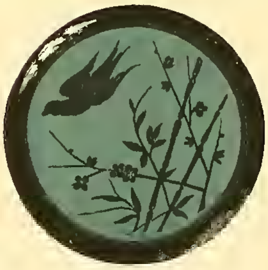
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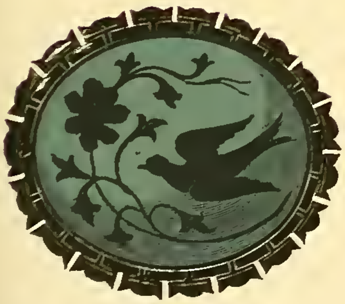
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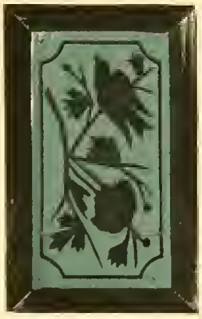
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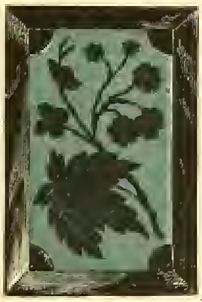
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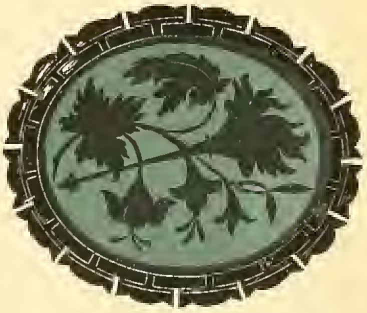
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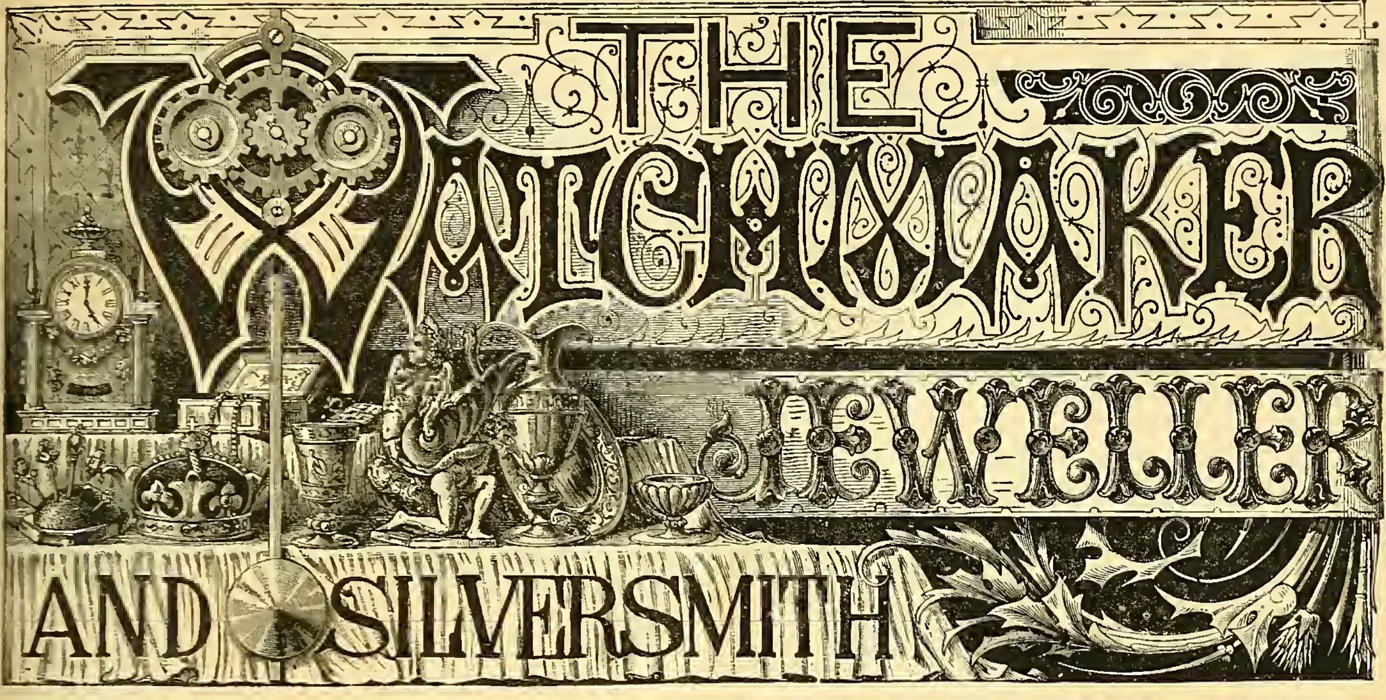

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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THREE SUPPLEMENTS:—1. Parisian Novelties; 2, Antique Rings and Ornaments; 3, Hirst's Patent Jet Mosaics.

No. 79.—Vol. VII.] DECEMBER 5, 1881. [Subscription, 5s. per Annum. Post Free.

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

Continued from page 83.

"Simplicity in mechanics is the chief excellence."

THE above sentence is generally attributed to the great engineer and watchmaker, James Watt, but there is scarcely any writer or mechanic who has directed his attention to the construction of mechanism, of which it does not form part of his creed: and no essay on this subject, no matter how short, can be said to be complete without it. It is somewhat like the doctrine of charity in the Christian Church, which has been so universally admired in all ages, that its orthodoxy has never been called in question. Guided by this wise precept, let us examine, with a view to improvement, some popular forms of key and keyless going barrel watches, and in all such enquiries let it never be forgotten that the going barrel field is well-trodden ground; here are footprints of Dr. Hooke, Berthoud, Arnold, and Brequet—in short, it has been the study of every eminent watchmaker that has ever lived, and it is therefore too much to expect any great radical improvement; but we are not for this reason to conclude that its construction and manufacture is not capable of revision and amendment. Science is ever progressing, and circumstances arise of which our forefathers had no knowledge, and therefore could not control. The first I shall bring before your notice is the one in which the centre wheel is placed in the top plate; it is the most frequent in use on the Continent and in America, but rarely adopted in this country; and the reason for our rejection of it will, I think, not be altogether void of interest. The following are the disadvantages attending this arrangement. (If the reader will place before him a Geneva bridge movement which has the centre wheel above the barrel, and an English three-quarter plate going barrel movement which has the centre wheel in the lower plate below the barrel, he will be helped in this study more than by diagrams).

1st. In order to economise space and give height to the barrel, the centre wheel must be placed in the frame on a level with the ratchet; this reduces the diameter of the ratchet more than is desirable for safe working. It also introduces many difficulties and much weakness in the click-work, which are not compatible with English notions of strength and durability, and which are daily attended with danger when the wearer winds up his watch with a key; and so long as the Swiss watch contains this error in the great work, and others which I will presently point out, it must continue to be in the future what it has always been in the past—a proverb for weakness. Brequet, to whom this arrangement is generally attributed, was a most sagacious mechanic, and he saw the defects I have pointed out; and to remedy them; he invented the Brequet, or, as it is sometimes called, the drunkard's key, which, as everybody knows, is a combination of horizontal ratchets actuated by a spiral spring which prevents the key pipe from being turned backwards, and so saves the ratchet from being stripped of its teeth; and though the Breguet key is generally well made at a low price—a rare combination—yet this marvel of cheapness has not been generally adopted, and has therefore failed to serve the purpose for which it was designed. It seems to me a mistake to attempt to get rid of one weakness in a machine by adding another, and I know of nothing more damaging to the reputation of this great, perhaps greatest, of horologists, than the inventing of the key that is called by his name. The scope and design of an invention should always cut at the root of the defect, not only lop off some of the branches. It is one thing to diminish an evil, but it is quite another thing to do away with it altogether. American watchmakers are evidently beginning to feel the force of what I say; for in some of their recent models, which retain their centre wheel in the top plate (*e. g.* the Waltham watch named "Hillside)," they have removed the clickwork from the top plate on account of the smallness of the diameter of the ratchet, and placed it in the lower plate, and greatly increased the diameter of the same: in so doing, they have greatly diminished the height of the mainspring, and done away with the stopwork altogether.

2nd. To save space, the hour wheel is placed level with the stopwork, and to free each other the diameters of the motion wheels and stopwork must be much smaller than is desirable, which increases the cost of the former and materially reduces the strength of the latter. The strength of a going barrel stopwork is in the diameter rather than in the thickness, and therefore should extend to the edge of the barrel. The weakest point is the stud on which the starpiece is screwed. The spaces in the star-piece in which the gatherer operates should be cut as shallow as possible consistent with safe working, thereby leaving the centre of the starwheel as large as possible, which may be cut out and sprung on the stud like an index on a balance cock. This plan, which we generally adopt in England, is stronger, cheaper, and therefore better than the Swiss.

3rd. The centre wheel in a flat watch being level with the balance spring, its diameter is curtailed, and therefore that of the balance has to be made smaller than is desirable.

4th. The length of the winding square either militates against the height of the mainspring, or increases the thickness of the watch. This objection is common to all forms of going barrel watches. Breguet's keen eye soon discovered this fault, and his wonderfully suggestive mind invented a remedy: it is the one known as the sollaclave, which consists of making a square hole through the barrel arbor, and then using a solid key to wind up the watch. There are some interesting relics of this invention in the museum of the Clockmakers' Company, deposited in the Guildhall Library. I can see no objection to its use, and think it might with advantage be employed in the cheaper kinds of watches. I may add, it has been for many years successfully applied to a neat watch with a single bottom case by Mr. Jackson, one of the esteemed Vice-Presidents of the British Horological Institute, who has been the most persistent and consistent maker of going barrel watches in this country.

Now, if the reader will compare this arrgngement of the going barrel with the centre wheel in the top plate with the one used in this country, which has the centre wheel in the lower plate, he will see at a glance that the diameter difficulty is at once got rid of. To wit, the ratchet which is placed in the back plate, with ample space for thickness, may be brought into close proximity to the hour wheel, which makes the clickwork so strong that it cannot be broken by turning it back, an advantage which even the fusee watch does not possess. Again, the stopwork can be extended to the edge of the barrel, and made so strong that it is scarcely possible to over-wind it, and the centre wheel in no way interferes with the freedom or diameter of the balance or pendulum spring. But, in getting rid of this diameter difficulty, he encounters another—a very serious one; the height of the mainspring is reduced by our arrangement of the centre wheel in the lower plate, and anything which reduces the height of the mainspring is fatal to a going barrel watch. The difficult problem, I almost think I may say the only difficult problem, in a going barrel watch is to put in a movement of 0-10 pillars, a thin broad mainspring that will make at least five and a-half revolutions of the barrel, and yet have sufficient power to propel a heavy compensation balance. In a 14-size watch, the balance should weigh 12 grains, and vibrate not more than a turn and a-half when wound up to the top, nor less than a turn and a-quarter after going 24 hours. There is no difficulty whatever in applying a broad mainspring, such as I have described, to a thick watch; but the misfortune that attends such a machine is this—it is not saleable on account of its thickness. There is no difficulty whatever in applying a narrow mainspring to a flat watch; but such a watch, when made, will not go. The distinguishing feature of our best English lever watch is its *heavy balance*, with ample power for vibration, which best overcomes the unlocking resistance, and the constantly varying resistance caused by the thickening of the oil. The *permanence* of the rate depends chiefly on the weight of the balance. No doubt highly satisfactory results may be obtained from a light balance, such as we read of in the reports of jurors of exhibitions and observatory trials, which extend only over a few days or, at most, a few weeks, but such tests are by no means satisfactory records of progress. So long as we maintain the speciality referred to, we shall always maintain our reputation for high-class timekeeepers.

To return, for I am straying away from my subject: the question that will naturally suggest itself to a thoughtful mechanic is this—can we secure the advantages of increased diameter and freedom which belong to the English movement, and combine with it the broad mainspring of the Swiss movement, and to these important characteristics add the desideratum, a long winding square? This question I am prepared to answer in the affirmative. I am quite sure that they can.

The foregoing remarks apply, for the most part, to key watches; now let us look at a movement which has the centre wheel in the top plate, when used for keyless mechanism.

The winding-wheel attached to the barrel-arbor has to be placed over the centre wheel, which lowers the barrel, and, therefore, diminishes the height of the main-spring; again, when the watch is open-face, with seconds at six o'clock, the arbor of the third wheel must be placed near the periphery of the barrel, and the third wheel over the centre wheel, which further reduces the height of the main-spring, and makes this arrangement inferior to the one used in this country for keyless mechanism.

Here I desire to remark that I am not speaking on the centre wheel on the top plate of a *fusee watch*, to which Mr. Grossman has recently directed our attention (see page 44). But I may embrace this opportunity of stating that this invention of Mr. Grossman's is not new. It was patented in this country as far back as the year 1843, by G. E. Mylne, and, for the convenience of the reader, I reproduce an abridgement of the specification of the patent,* and at the same time direct attention to a serious drawback in this arrangement, viz., that which is *gained* in the height of the fusee and mainspring is *lost* in the length of the winding square, the great wheel being near the top plate prevents sinking the pivot and square into the fusee, which leaves the advantage, so far as a key watch is concerned, *nil*. Yet, I think, it might be turned to good account in a fusee keyless work, which is in a lamentable condition. Let us hope Mr. Poole's prophetic pen will predict for us a brighter prospect than the one presented to us in his recent letters on "English Keyless Watches."

RICHARD WHITTAKER.

(*To be continued.*)

The Future of the English Watch Trade.

(INTRODUCTORY.)

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Charles Dickens, in "Dombey & Son," has made a well-known character say, when attempting to make a speech, that he felt he could express himself in a remarkable manner if he could only make a start: and for the past month, since I forwarded you the above title for a series of papers, I have fully sympathised with the difficulties of the gentleman in question.

The attempt to foretell the future merges on the science of astrology, the devotees to which have been so graphically described in the pages of fiction, notably by Sir Walter Scott. Let me take an illustration from one of his works, "Guy Mannering," where an amateur astrologer, after erecting the horoscope and calculating the scheme of nativity of a newly-born infant, discovers that "Mars, having dignity in the cusp of the twelfth house, threatened captivity or sudden and violent death to the *native*." This latter word, Sir, struck me as being applicable to the topic under discussion: the question which concerns us all is, whether in this twelfth stage of the English watch trade, the threatened danger of annihilation by fair and unfair foreign competition, taken in conjunction with our decreasing powers of production, is to be successfully averted!

It is an indisputable fact that a large section of the public demand a cheap watch, and a cheap watch they will have, whether English or foreign. Furthermore, they have very little sympathy for us in the competition we have to contend with. They think that we ought to be able to do unto others as others do unto us, and carry our productions into foreign markets in spite of hostile tariffs and legalised systems of fraud. The following letter, which was addressed to me by an influential gentleman shortly after the publication of my letter in *The Times*, reproduced in the last number of this Journal, will, I think, be interesting to your readers, as it fairly shows the feeling of the intelligent public on the question:—

> Dear Sir.—If you will excuse me for troubling. I should be obliged if you will inform me why "watch cases cannot possibly be manufactured in England as cheap as abroad?" My curiosity does not arise from knowing anyone connected with the trade, but because I cannot assign a reason. Is it that women work at the trade, or that the foreigners are more skilful? Or, that the workmen get a better technical education abroad? Some people say wages are lower abroad; I suppose living costs less, too. I do not know if it is in Switzerland, or where it is, that watch cases are manufactured. When I have been travelling abroad, I have found that the industrial class get a much better education at the public cost than they get in this country by a moderate payment.
>
> Yours truly, ————
>
> St. James's Street, Oct. 28th.

It will be readily seen that the writer does not grasp the idea that cases are marked here in order to enable the remainder of the watches to be made abroad, which has the effect of greatly stultifying all attempts which are being made to extend our trade. It is, however, possible to do much more than we have been doing of late years, if the necessary organisation could be set on foot, the practicability or desirability of which will afford a theme for future papers. Some years ago Mr. E. D. Johnson, in the course of a conversation which I had with him, pointed out that it was a strange anomaly that a wealthy and influential locality like Clerkenwell should have no road named after it. We now have a Clerkenwell *Road;* but, let me ask, what is the commercial position of the Clerkenwell *watch?* With the exception of a few makers of high reputation who seem to have the onus put upon them of giving publicity to English productions, the Clerkenwell watch is practically ignored at the present time; and until our trade is placed on a fair and honest basis, the influx of foreign-made goods will continue. There are, however, significant "signs of the times" in the horizon, and I believe that those manufacturers and retailers who have conducted their businesses in a honest and honourable manner will not be without their reward.

I have already, however, taken up much more of your space in these opening remarks than I intended, and propose next month to divide the subject into suitable divisions. Let me add, that the knowledge which I have of the large and rapidly increasing sale of this Journal gives me an additional interest in contributing to its pages.

I am, yours, &c.,
JAMES U. POOLE.

33, Spencer Street,
Clerkenwell, E.C.

Erratum.—In the report of "Greenwich Chronometer Trials," which appeared in our last issue, in centre paragraph, 12s·10 ought to have been 13s; 27·6 should be 27·9; and 22s·1 should be 23s·1. Lower down, 140° F should be 104° F.

◆

Hatton Garden is becoming famous for diamond and jewellery robberies. Everybody has, of course, heard by this time of the last good haul at the post-office in that locality; but, like in the previous cases, no doubt still fresh in the recollection of our readers, the perpetrators will probably never be brought to justice. The Hatton Garden burglars are not of the ordinary bungling kind; they lay their plans carefully, and when they get their booty, know where to go with it. It is reported that the bulk of the loss will fall upon the Alliance office.

The authorities have practically completed their inquiries as to the contents of the registered packets stolen from Hatton Garden post-office on the 16th ult., the result being that the aggregate value is found to have been considerably less than was at first estimated. Fourteen of the packages contained cut and rough diamonds, sapphires, &c., worth £14,330, the other valuables included in the robbery comprising watches, chains, rings, bracelets, postage stamps, and cheques. It is believed that the principal articles on which insurance had been effected were 14 consignments of diamonds, valued respectively at £5,000, £4,000, £2,500, £500, £450, £400, £400, £400, £275, £200, £100, £50, £32, and £24.

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* A.D. 1843, October 21st.—No. 9915.—MYLNE, George Edward.—Watches made with sinks in the pillar plates for the barrel, third and fourth wheels and fusee: whereby full framed watches may be made flatter than heretofore. The fusee is similar to the plain or common fusee, but it has a thin circular steel cap, and is inverted, and is cut the reverse way.—Specification printed, price 8d. See Repertory of Arts, vol. 4 (enlarged series), p. 91; Mechanics Magazine, vol. 40, p. 318; and Engineers' and Architects' Journal, vol 7, p. 155.

Repairing Swiss Watches.

By Hy. Ganney.

(Continued from page 58.)

No. XI.

WE now propose to give some details concerning the other escapements used in Swiss watches, for though it is usual to associate the horizontal escapement with Swiss watches, it is doubtless quite true that they manufacture a larger number of lever and duplex watches than any other country. Great improvements are apparent in their lever watches of late years; a few years ago a Swiss lever that would give satisfaction was a rarity, but owing in a great part to the impression created by the success of the Americans with popular Swiss watches, and their avowed object in securing the trade of their own continent, and their competition with them in European markets, they have been stimulated to introduce many features which make the Swiss lever quite a different thing to what it was years ago, when repairs to them were seldom attempted; if they went with cleaning, well and good, if not, the wearer was advised to get another. The fact that all the actions were jewelled, and the levers very long and heavy, almost put it out of the power of the jobber to effect any alteration. To make the depths of the escapement as light as possible, to secure the greatest amount of vibration, or to hammer out the lever if there is too much play on the banking, was all that could generally be done, as there was a vicious practice of making the lever and roller of the worst possible shape; the guard pin and roller action was with them made by forming the lever into a sharp edge, and the roller also being made with a sharp edge, a constant tendency to cut or stick into each other was observable. This form has now been pretty generally abolished in favour of the English plan of brass pin and broad roller edge, and they further imitate the English by adopting the brass ratchet wheel; this is a mistake, as the club tooth is a stronger and more correct acting wheel, and gives more vibration to the balance, as the escapement can be worked closer with less drop and more freedom, and the friction and action on each pallet are more equal. It would be a matter of little consequence if one pallet supplied nearly all the impulse, so that none was wasted, as equality of impulse is not an element in timing; the best timing escapement—the duplex and chronometer—have the impulse all in one direction, but in the lever we have the locking resistance, which is always in the same ratio as the impulse, and a small impulse being preceded by a strong locking, may cause the watch to stop. Inequality of locking resistance is a very common fault in Swiss levers, the draw on the second or exit pallet being very strong, almost sufficient to prevent the escapement unlocking, whilst the other pallet has no retentive action. With a sound guard action very little draw is needed to Geneva levers, and if the draw prevents a performance as the oil gets dirty, it can be made less by taking off the corner of the inside locking face with a diamond mill and emery polisher, which may be made from two ferules turned true and suitable shape and charging them with diamond dust and emery, and revolving them in a lathe; or with the bow and turns, holding the pallet against them whilst revolving rapidly; a corner may be very readily rounded. A pallet maker, of course, would do the job much better, but this class of watch is seldom worth the trouble involved in sending defective parts to a specialist, and the jobber must depend upon his own resources and mother wit; and much of the skill the practised jobber possesses is owing to the abundance of this class of work, as the best work generally needs, and will warrant, the employment of the special talent used in producing it. Pallets can be altered considerably by warming them to melt the shellac with which they are fixed in the steel, and may be put closer or wider, deep or shallow, by this means; or the hole may be drawn with a fine file, altered and closed, and, in fact, any alteration may easily be made that a good knowledge of the escapement and experience suggests. Without a good vibration, performance is almost out of the question, and a small vibration that will give good results with an English lever is quite useless with a Swiss one, as the escaping angle is generally very large, and the balance has to move about sixty degrees for it to escape. There can be no question that a good Swiss lever with the large light lever and roller and club tooth steel wheel, is a very reliable and durable article; and it needs no prophet to foretell a very large trade, if the new forms of lever and roller are applied to this lower quality work. In the old forms the wheel had quite enough to do to move the lever and pallets, and soon tired of swinging the balance also. If there is too much play between the guard point and roller, the steel may be filed away and a hole drilled, and a pin put in, English fashion. If that is too much trouble, and the steel is soft, a slitting file may be used to cut the steel into the form of a pin, and it may be bent over, or a pen-knife and hammer will force the steel outwards; if the roller is taken off, the sharp edge may be removed with advantage, as the edge soon damages and prevents handling it. The steel clams, and a hollow punch over the pivot, and a drive with a hammer, is the best way of getting the roller on and off, as they are never fitted well enough to take off with ordinary hand pressure. The fine steel clams used for rivetting will generally force off a lever roller, by putting it in the vice and screwing it up gently. The jaws of the clams pressing the backs of the collet of the staff and roller simultaneously, one of them must move, and it is generally the roller that moves first; but the clams must be thin and regular, tapering at back. I have in use a pair of English clams used by my grandfather for fifty years, and they will take off any roller without fail. I have another pair of clams of the same size, but of common modern make, which destroys every staff on which the experiment is tried, so it is necessary to discriminate in using such a tool. I believe there is a tool on this principle specially made and sold at the tool shops for this purpose; but I desire nothing better than my grandfather's clams in the bench-vice for the purpose. First-class escapement makers use pliers and sliding-tongs of brass, or with brass rivetted or soldered on the ends, to remove the roller, and will be surprised to find the bench-vice and clams in requisition to persuade Swiss rollers to move. Every jobber should have these brass-nosed pliers, as they hold the roller without damage, while rough roller edges cause very troublesome stoppage of the balance occasionally.

The amount of vibration may often be considerably increased by closing the lever notch, as all unnecessary shake there is wasted power. Fitting a layer oval pin will be too much trouble, so the hammer must be used to close the lever notch if the steel is not hard. As the action of the roller and lever are in the sink of the plate, and cannot be viewed direct, considerable judgment and observation is necessary to see and understand them, as nothing is so good as a direct view in a line with the light of a delicate action, which in this case is impossible. The end shakes of all the escapement must be carefully made alike, or the ruby pin may get on the lever notch or the guard action under the roller. A lever and roller may foul in some positions, as, owing to the great length of lever, ordinary side-shake of pallet pivots allows of considerable motion of the lever end. It will hardly be possible to poise the lever, so the guard action must be perfectly sound. The action of the wheel and pallet may be as shallow as possible; if put as deep as is usual in English watches, the watch will soon stop, as the long lever and roller give advantages in preventing a recoil of the pallets, and allow of a lighter depth, which is necessary to prevent waste of force in unnecessary motion of heavy levers and hard lockings. More play of the guard action is necessary in the Swiss lever, as the action is more coarse and magnified: the tightness and accuracy usual in the English lever and roller action is not necessary, and would be fatal if applied, as side-shake and freedom must be increased in proportion as the increase in size of lever and roller, but perfect soundness must be obtained.

(To be Continued.)

Self-winding Watches.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Can any of your numerous readers give me any information concerning the self-winding watch made by Breguet for the first Napoleon, as I am desirous of learning why the plan fell into disuse, to be revived again lately by an Austrian engineer, H. V. Loche. As these watches are being made in considerable quantities in Switzerland, and are being sold in this country, English watch manufacturers might turn their attention to them, as the inventor is, I understand, desirous of using English skill and reputation in connection with their manufacture, and the peculiarities of the winding are such as English fusee makers are the most capable of executing. I may be doing them a service in calling attention to a source of employment for their skill, which is much needed just now, as the going barrel keyless watch is superseding fusee work of high character, the complication of the fusee being inapplicable to keyless work. Keyless watches will doubtless entirely supersede those in which a key is used. On the principle, I suppose, that every man is his own worst enemy, it is apparent that watch-making, as a commercial venture, owes least to those who pursue it for a livelihood; all watches being troublesome, innovations and improvements are stoutly opposed by those who are most likely to benefit by them. The trade is now very busy in keyless work, because wearers of good key watches have learned that keyless watches are more convenient, and also prevent that meddling with the interior mechanism — the introduction of dirt and wear of joints, which allows more dirt and damp air to enter: and the general performance of the watch is improved by the utilization of the room required for the key square allowing a better mainspring, and the substitution of sounder ratches and clickwork: while the cost of the extra original outlay is soon covered by the lessened cost of repairs. It is obvious that key-winding watches will soon be as obsolete as vertical ones. From a watch that can be wound without opening the case, to one that winds itself, is a great step, but if it is a fact, all other things being equal, the keyless watch will be superseded by the self-winder, just as striking clocks superseded the necessity of calling the hours or tolling the curfew. As a preventative of loss of time by forgetfulness in winding, the advantage is very great; and considering how numerous the wealthy and indolent are in Europe, forming a distinct caste, preferring to fee doctors and take physic to securing health by work and exercise, it would seem as natural to keep a servant and do the work yourself, as to take the trouble to wind a watch if, by a slight addition to the mechanism, it can be made to wind itself.

Is it practical? In answer to that, I have worn one some time, and have never had to wind it, and have only to complain it is getting me into the habit of forgetting to wind another watch I wear: knowing I have a watch that will go without winding, I find my mind does not give the attention to the subject it used to do, and I shall have to cease wearing one or the other. One cannot serve two masters, it seems in this case, a watch that wants daily attention and one that does not. Now, as to the means which secure a self-winding, most people are acquainted with the pedometer, an instrument the size of a watch, which, placed in the pocket, registers the number of steps a man makes in walking. The pedometer, I suppose, is not now much used as a distance indicator, as it not only registers the steps in walking, but any motion made whilst sitting or riding, or even moving any portion of the body or limbs of the wearer, and proves itself that worst of servants, one who does too much; sufficient for the purpose thereon is the secret of the resources of modern civilisation.

A weighted lever or pendulum held at a right angle to gravity by a spring which maintains it in that position, any motion of the wearer causes it to vibrate a ratchet, and clockwork being attached to the vibrating arms, the motion is communicated to a train of wheels gearing into the ratchet wheel on the barrel arbor, and we have a counterpart of the ordinary train of wheels in the form of another train picking up a number of quick motions, and transferring them with increased power through each wheel and pinion to the mainspring, which they wind as a reservoir of power; from thence it is distributed to the balance through the ordinary watch train with increased celerity, but diminished power, until expended on the balance itself. As both train of wheels travel at about the same rate, the one to wind the spring in the barrel, and the other from it to unwind it, the thought is suggested as to the possibility of attaching the winding pendulum direct to the escapement, and save the gearing to and from the barrel, and a watch with one or two wheels, minus barrel and spring, would be the result. Were it not for the necessity of having a large reservoir of power for use during the night and periods of rest, it could be accomplished. It is not necessary to use a fusee to equalise the power, as the spring runs when at rest 56 hours, enough of it is never used to necessitate adjustment of the motive power. As fusee-makers are finding their occupation gone, they may steal a march on their destroyers by constructing the ratchet work and wheels which form the peculiarity of this device, which is really a less addition to a watch than that involved in fusee and maintaining work, and, acting on the principle of "diamond cut diamond," win a large trade. As English watchmakers are unrivalled as going fusee-makers, the necessity of very superfine work is not apparent, as the watches are being retailed at four and five pounds, which does not allow of very fine work, and the watches in use are unnecessarily complicated with an indicator to let the wearer see how much or how little it is wound whenever he pleases. Those who know what a bugbear a going barrel indicator has always proved, will wonder how a watch with an indicator can be made for the money, without any novelty in winding; arrangements to take off the action when fully wound are also in it, but could be suppressed with advantage, using a slipping mainspring instead. Like the early keyless makers, a square for winding with a key is left; this also can be suppressed, and if a wearer has one of these watches and knows nothing of its peculiarities, he can ignore its winding properties, and wind it every day, and be none the wiser, even if he forgets to wind it; but his watch will be all the better for the extra mechanism. Failure of the clickwork is a constant fault in watches, and breakage of teeth and pinion the result; this is impossible with this watch, as the action forms a triple clickwork to the mainspring; and supposing, what is impossible, all the clicks fail, the mainspring and arbor being in connection with a train of wheels, can only run down slowly and easily, and the invention for this only, as an insurance against this most prolific source of disaster, is worth ten times its cost; and when we add the train to wind it, only three wheels and pinion working like ordinary motion wheels on pins, it is evident there is plenty of power to spare, or they would be pivotted and jewelled. In common watches the invention has great merit; what its value in high-class work will be, time alone can tell.

Yours, &c.,

H. GANNEY.

Watch and Clockmaking Abroad.

No. 1.

Various Dispositions of Bows.—The three following diagrams represent constructions of bows, patented in France by Monsieur B. Callier, chronometer maker, of Paris. The system in Fig. 2 is said to be much appreciated by the public.

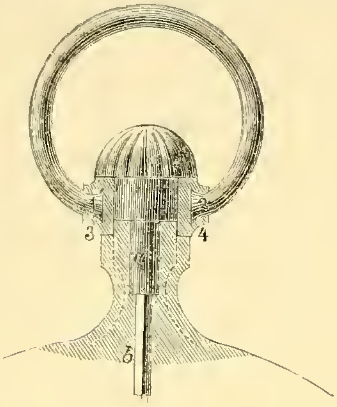


Fig. 1.

At 3 and 4 (Fig. 1) a section of an horizontal ring is shown, pierced at 1 and 2, to receive the extremities of the bow, but, by an error in Fig. 1, the holes which receive the ends are not cut right through as it should have been done. The correct section of the ring will be seen at 4 (Fig. 3). The ends of the bow are placed into the holes of the unconnected ring, and then driven together, so that they cannot get out of the ring again. The latter is then placed and tin soldered, which is quite sufficient. The system can be applied with ease and little expense to the hollow bows in rencontoirs.—*B. Callier, in "Revue Chronometrique."*

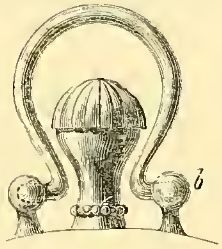


Fig. 2.

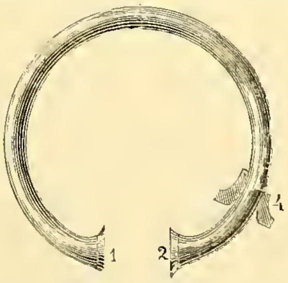
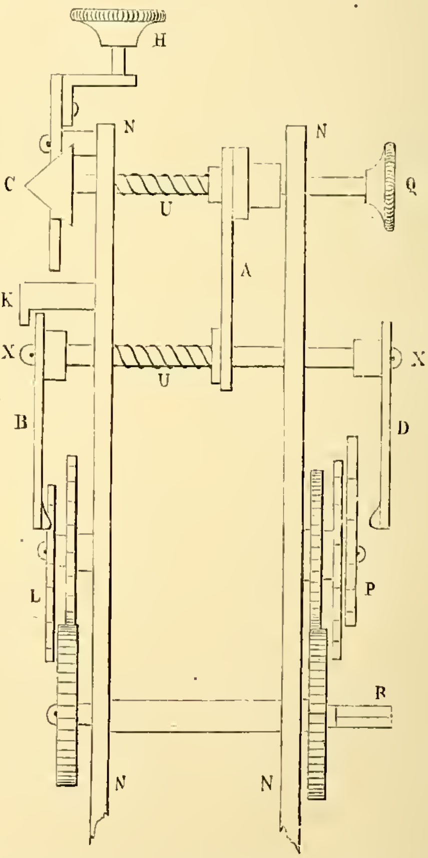


Fig. 3.

Travelling Clock repeating the Five Minutes.—We have clocks repeating the hours and quarters, and some have recently been made which strike the minutes, but they are very complicated and very costly. The accompanying illustration represents the mechanism of a clock which will give the time as near as five minutes, while its cost is only a trifle more than that of a clock repeating the hours only. N N, N N are the plates of the clock in profile; the side of the dial is the left; H, the ordinary button which is pressed to ascertain the hour; Q, a second button, which is pushed so as to hear the number of five minutes it is past the hour repeated. The same wheelwork, the same hammer, the same bell, and the same dial-work serves to strike the hours or the five minutes; and as they are sounded one after the other no mistake can be made, especially as the button Q repeats the minutes only. Now, let us suppose an ordinary travelling clock movement striking the hours, such as we find them in the market: X is the axis of the hour rack, its arm B falls on the snail L. If we press H, the action will be as usual, but the rack, instead of pivoting on a stud, turns on a staff traversing the whole frame, and which carries at its extremity X′ a second arm D, intended to fall in the minute snail P. This snail, like the snail L, makes a turn in an hour, and is numbered on a star drawn by the hour setting arbor R. The arbor of button Q carries a cone C, which causes the rack to fall, like the button H does. An arm A acts at the same time on the arbor of rack X, and pushes this arbor from X′ to X. It exposes thus the arm D with the snail P, and disengages the arm B from the hour-snail L; from that time the strokes will be regulated by the five-minute-snail P, and not by the hour-snail L. Thus the repetition of the five minutes is secured. A bridge, with a projection K, keeps the hour-rack disengaged with its snail, until it returns to its point of rest; and the springs U return everything to their respective positions. Thus, an ordinary hour-repeating clock serves to repeat the five minutes, by a special pusher, which changes the action of the rack arms. The action of the minute-pusher only changes the snail in which the course of the rack is regulated, the rest undergoes



no alteration whatever. We do not insist on small details, as the simplicity of the principle shows that these effects are not subject to any practical difficulty.—*A. Redier, in "Revue Chronometrique."*

Sketches Showing the Action of Lever Escapements, Exhibited at the Last Exhibition at Chaux-de-Fonds.—Construction by Mr. L. Camille Calame, professor of technical drawing, at Chaux-de-Fonds.

Engaging Lift.

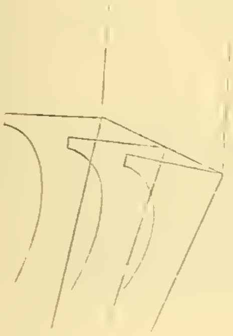


Fig. 1.

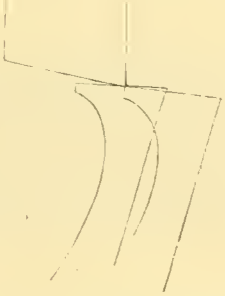


Fig. 2.

Fig. 1. Action of the edge working with the tooth against the inclined plane of the lift. Fig. 2. Action of the edge working with the lift against the inclined plane of the tooth.

Disengaging Lift.

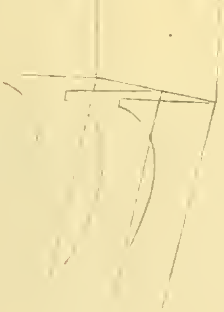


Fig. 3.

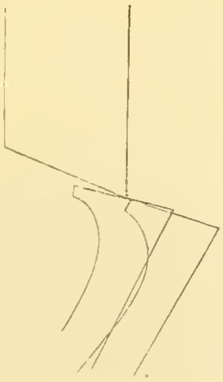


Fig. 4.

Fig. 3. Action of the edge working with the tooth against the inclined plane of the lift. Fig. 4. Action of the edge working with the lift against the inclined plane of the tooth.

Remarks.—What deserves to be pointed out in this new construction of the Swiss lever escapement, is the minute analysis made of the movements which must be executed: the two lifts working in the same manner with the least possible friction (first the acting with the teeth bear against the inclined planes of the lifts, then the edges acting with the lifts against the inclined planes of the teeth); and the fact, which is the most important in a construction, that the results obtained correspond with the data with mathematical exactness.

The action of this escapement is similar to the one indicated by Moinet, in his excellent *Traite d' Horlogerie*, but the latter has never given a construction to secure this result. The problem of an exact graphical construction of a Swiss lever escapement with equi-distant rest, has thus found its long sought for solution.

Construction after the Data of Mr. J. Grossmann, Director of the Watchmakers' School of Locle.

Engaging Lift.

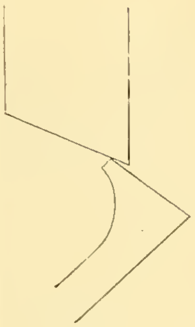


Fig. 5.

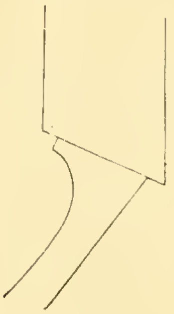


Fig. 6.

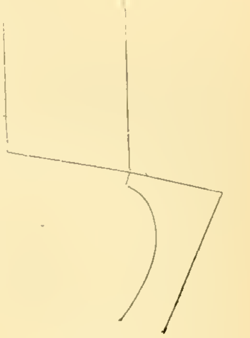


Fig. 7.

Disengaging Lift.

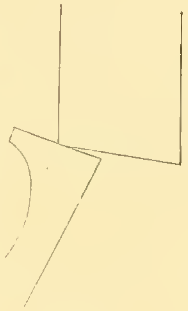


Fig. 8.

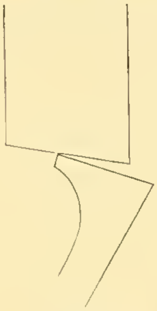


Fig. 9.

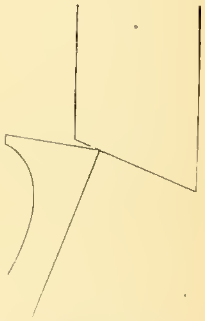


Fig. 10.

Remarks.—The two lifts work quite different from each other. The inclined plane of the tooth begins to produce the angular movement on the entering lift by bearing against the commencement of the inclined plane of the lift, and the movement is then continued by means of the inclined plane of the lift, the heel of the tooth acting against the latter. On the disengaging lift it is the inclined plane of the lift which commences to turn the lever, being in contact with the edge of the front of the tool; these two planes work then at the same time, the whole of their surfaces being in contact; afterwards, the inclined planes of the lift *continues again* the angular movement, but this time it is the heel (ruse) of the tooth which acts to produce the motion.

Models of escapements were also exhibited by the schools of Chaux-de-Fonds and St. Jmiér, the first constructed under the direction of Mr. Heinis, the second under that of Mr. Junod; but these must have been constructed after the method of the Locle one, as they all perform under conditions which may be called identical.

Another escapement shown is constructed from the description of M. Grossmann, Glashütte, in his *Treatise on the Lever Escapement*. The great disadvantage of this system is, that it results in unequal rests, the rest on the disengaging lift is about double of that obtained on the entering lift. As regards performance, the action in the entering lift resembles very much that obtained by Mr. Camille Calame, but it differs sensibly in the disengaging lift. Another special point is that the inclines of the teeth and lifts do not raise the anchor to the number of degrees indicated by the data given, which comes from the fact that the constructor did not account for *the distance lost or gained by the displacement of the inclined planes.—Mr J. André Jeanneret, in "Journal Suisse d'Horlogerie."*

Gems and Jewels—in Relation to their Biblical History.

By J. W. Singer.

(Continued from page 72.)

No. 5.—The *Sapphire*, in the Hewbrew "Sappir," and this is one of the stones most often mentioned in the Bible, as being of great beauty and value. Legendary tradition said that the Tables on which the Ten Commandments were engraved were of sapphire; and to this stone was assigned the virtue of preserving the sight, and invigorating the body as well as the soul. This stone is the only one having the same name in all languages, with little variation, and means the same character. Modern science has shewn it to be exactly the same stone physically as the ruby, having the same composition, hardness, electrical and other properties, and only differs as to colour. It is found of all colours, but that shade is best called "bleu du roi," and to be perfect should be blue by candle-light as well as by day, most of them being black in candle-light. It is of the next hardness to a diamond, that being the only stone that will touch it. This gem seems always to have been considered a most fitting one for sacred use, and thus of old was dedicated to Apollo, and was to be worn when enquiring at the oracle of his shrine, being said to prevent evil and impure thoughts. Boetius says that on account of its attachment to chastity, it was worn by priests: and now a cardinal, when he receives the purple, has a ring with a sapphire set in it for state purposes.

No. 6.—The *Diamond*, in the Hebrew "Jahalom." The Hebrew word is said to be derived from the verb "Jalam," to strike, and hence given to this stone to describe its superior hardness. The intricacy of this research will be better understood in thinking how little is known of the history of this most generally used stone, the diamond. The modern Hebrew name for this stone is "Shamar," and is mentioned in this form four times in the Bible. First in Ezekiel iii. 9, "As an adamant, harder than flint, have I made thy forehead; fear them not, neither be dismayed at their looks, though they be a rebellious house." Meaning to show metaphorically how firm God's servants should be. Here the word is rendered "adamant," which is almost the same as the Latin word for diamond, which is "Adamaus;" but notwithstanding this connection of terms, the old Greeks are supposed not to have meant a stone at all, but some metal of invincible hardness compared to bronze, and thus they spoke of the "adamantine chains" of Prometheus, it having been disputed whether the ancient Greeks knew anything of the diamond or of steel. As knowledge increased, the name became to be applied to the hardest kind of stones, and ultimately to the diamond only. The word occurs again in Zechariah vii. 12, "Yea, they made their hearts as an adamant stone, lest they should hear the law," meaning to show the hardness of man's heart against the truth. The same word comes again in Jeremiah xvii. 1, but it is here translated "*diamond*." "The sin of Judah is written with a pen of iron, and with the point of a diamond it is graven upon the table of their hearts, and upon the horns of your altars." Also it occurs once in the Apocrypha, Eccl. xvi. 16, "He has separated his light from the darkness with adamant"—that is, an adamantine wall, impassable and irresistable. The modern word diamond is mentioned in three other places in our version, but the original word used is not the present Hebrew term, *Shamar*, for that stone, but the former term mentioned of Jahalom. Many have supposed that by the word "jasper" a diamond was intended to be understood; thus, in Rev. iv. 3, it is said to be "the emblematical image of the glory of the Divine Being," and in Rev. xxi. 11, "to be most precious, and like a crystal." Tradition asserts that the stones used in the construction of Solomon's Temple were hewn by means of the shamar, fixed in some tool, as the law of Moses prevented the use of any iron tool. It may not be out of place to mention that all the *rock boring* now done by the Diamond Boring Company is done by means of the diamond, or the shamar fixed in a drill, and like the iron pen mentioned by Jeremiah, set with the point of a diamond. It is easy to imagine that if all this obscurity exists with the most popular of stones, how much more difficult to identify those less known.

No. 7.—The *Ligure*, translated from "Leshem." Some have rendered this to mean the turquoise; others amber; others opal, or tourmaline. Theophrastus said it was a belemnite kind of fossil, containing bituminous matter, because it became electrical on rubbing: but at present the name is obsolete, and not used for any stone.

No. 8-—The *Agate*—from the word "Shebo." The Rabbins translate this hyacinth, which is a stone something like an amethyst. The agate is a stone of the Chalcedony family, such as you often see boxes and cups made from, having often fanciful zigzag marks in it, and at other times marks of vegetation, and is then called moss agates, and when thus marked were much prized by the Greeks and Romans. Thus Orpheus said, "If thou wearest a piece of the tree-agate on thy hand, the gods shall be pleased with thee; and if the same be tied to the horns of thy oxen when ploughing, or round the ploughman's arm, wheat-crowned Ceres shall descend from Heaven, with full lap upon thy furrows."

No. 9.—The *Amethyst*—Hebrew "Achlamah." Rabbinical authors think this means our modern onyx, and have tried to find a scriptural basis for the superstitions attached to it by connecting "*achlamah*" with the word "*chulam*," to dream, because it was said to cause the wearer a multiplicity of bewildering dreams. In the last century amethysts were much thought of. Queen Anne had a necklace of these stones so fine as to be valued at £2,000, but they would not now fetch as many shillings. Most of the amethysts seen are only rock crystal, tinged with manganese and iron. According to modern custom, it is the only stone proper and allowable to be worn in mourning; and they are imported in vast numbers from Bohemia.

No. 11.—*Beryl*—from Tharshish. This is generally considered our chrysolite, and is the same stone as the aquamarine, and are very common, being sometimes found of large size, up to 60 and 80 lbs. each, and even one 32 inches long. It has the same crystalization as the emerald, a six-sided prism. The gem has been known for many ages, as the Greeks used it for intaglios two thousand years ago, and many beads of it are found in Egyptian mummy-pits.

(To be Continued.)

The Swiss watch industry, writes *l'Industriel Suisse*, is regaining its former activity, and everything predicts prosperous days for those connected with it; but watchmakers who expect the old order of things to return will certainly find themselves deceived, because watch manufacturing, like any other industry, must undergo a transformation. The workman must devote himself to that part of the watch for which he is best adapted, and not practice at various branches, as that would injure his prospect in earning good wages. On the other hand, manufacturers must specialize their productions, that is, apply the principles of political economy, which consist in producing much and good with little; it is in this that the whole secret of the superiority of one over the other lies. Low priced watches are actually in great demand, while workmen for fine and complicated watches are daily becoming scarcer, so that the time cannot be far off, when their services, too, will again be appreciated and adequately paid for.

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(Continued from page 77.)

135. Another plan has found much favour, and may be said to answer the purpose very nearly. The winding parts are exactly the same as described, with the only difference that the winding pinion is fitted loosely on a round axis, the inner end of which, as far as it projects from the winding pinion, is square. On this square a little steel tube, with a square hole, is adjusted, loose enough to move with ease up and down the square. The face of the winding pinion and the corresponding face of this tube are cut with ratchet teeth, forming exact counterparts of each other. A spring, acting in a notch round the periphery of the tube, keeps the two parts continually connected with each other, so that the winding pinion participates in the motion of the winding axis.

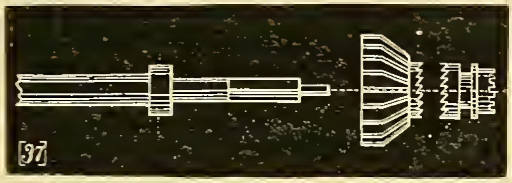


Fig. 40

136. When the setting of the hands is required, a small button or push-piece projecting from the case near the stem is pushed in, and causes the spring to slide the tube downwards on the square. The other face of the tube has a small set of contrite teeth which, by this movement, come into gear with the minute wheel itself, or another small wheel connected with the same. At the same time, the ratchet teeth of the tube are drawn out of action with those of the winding pinion, so that this latter does more; follow the movement of the axis, and when the setting has been done, the button released from the pressure allows the spring to bring the tube back to its former position ready for winding.

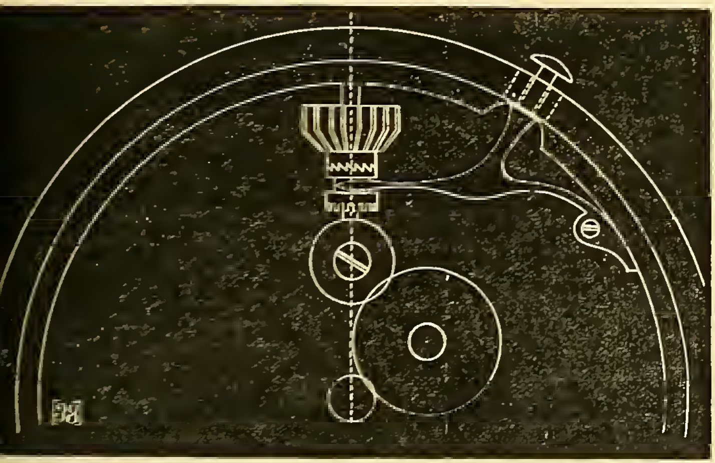


Fig 41.

137. There is a secondary advantage in this arrangement, inasmuch as it prevents any damage to the winding parts and clickwork, in case of anyone turning the winding knob the wrong way, because, in this case, the two ratchets produce the effect of a so-called Breguet-key.

138. Nevertheless, objections have been raised also against this system, because the side opening in the rim of the case for the passage of the button was thought a means of letting dust, &c., penetrate into the movement, and because the projecting button may, under unfavourable circumstances, be forced in while the watch is in the pocket.

For these reasons, much skill and sagacity was spent on other methods of setting the hands in motion.

139. One of them consists in a rather complicated arrangement of the bow of the case, establishing the connection with the motion work when the bow is put down. The advantages to be expected by this contrivance are very doubtful, since the bow may be accidentally put down in wearing the watch, thus bringing it to a stand-still. Besides, many people have the commendable custom of always putting the bow down when laying a watch flat on a table, in order to prevent the polish or engine-turning being scratched. This, of course, would lead to the same result.

140. Other contrivances have been made with keyless hunters, to the effect of having the push-piece protected by the front cover of the case, and projecting from the periphery of the bezel. This push-piece, when pushed inward, causes a part of its spring to get hold at the outer edge of the bezel, and from this moment the winding ceases, and the motion work is, and remains, in connection with the winding axis. This hold of the spring and push-piece is released by shutting the case, and every part is in its former situation. This plan answers excellently for every purpose, but if the hands are set without shutting the case afterwards, which some people do when coming home or going to bed, it will evidently stop.

141. From the foregoing observations some conclusions for the setting hands mechanism may be arrived at, and I always thought these parts ought to be constructed in such a way that:—

1*st—The motion work can never come into contact with them by any accidental cause; on the contrary, they should be so arranged as to require a decided act of the wearer to establish their effect on the motion work.*

2*nd—After having set the hands, the said mechanism ought to go out of gear with the minute wheel by its own action, and without requiring any care whatever of the wearer.*

These two principles are of the utmost importance for the good and reliable service of the watch, for a watch invariably stops if the keyless mechanism comes into, or remains in gear with the motion work at a wrong time; and a construction which requires a degree of care, which not all wearers bestow on their watches, must be called defective so long as other constructions may be attained without this weak point.

142. That kind of keyless mechanism with which the hands are set by laying down the bow of the case, implies a neglect of both the above principles. Those mechanisms which require the knob being pulled out, and those in which the push-piece keeps hold till the case is closed, are against the second of these principles.

(To be continued.)

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A Naval and Submarine Engineering Exhibition will be held at the Agricultural Hall, Islington, from the 10th to the 20th of April, 1882. The classification of exhibits includes barometers, chronometers, compasses, cutlery, meteorological instruments, sextants, thermometers, telescopes and other scientific apparatus. The names of some of our best known mechanical engineers are to be found on the list of patrons, and the arrangements are in the hands of Mr. Samson Barnett, Jun., 4, Westminster Chambers, S.W., to whom all applications for space should be made.

Fair Trade in Watches.

From the "Pall Mall Gazette" of Nov. 10th.

DURING his recent visit to Liverpool, Mr. Chamberlain received a deputation on one of the minor questions with which, it may be hoped, Parliament will some day be enabled to deal. Most of us buy one or two watches in the course of our lives, and there appears to be some anxiety in the watch trade that these transactions should be free from imposition. The anxiety is very laudable, but it would be less provocative of scrutiny were it shared by consumers as well as producers. The public are, however, singularly indifferent in the matter, and, but for the alertness of the representatives of British industry, would be totally unaware of the wiles practised on them by the insidious foreigner. It seems, in fact, that we are suffering from unfair trade in watches. No complaint is made of the importation of foreign watches to this country, but they must not be sold as if they were English work. The demand is intelligible; but it is not easy to see how, according to modern notions, it can be realized. Englishmen have got accustomed to the idea that every trade should take care of itself, and adopt all needful precautions against competition, whether fair or unfair. There is, indeed, no industry in which tales could not be unfolded of the unscrupulousness of rivals, and the injury thus inflicted on honest enterprise. It is, however, a different question whether the Legislature ought to preside over any manufacture to guarantee to the public full measure of good quality, and to protect the manufacturer against all competition that does not conform to a certain routine.

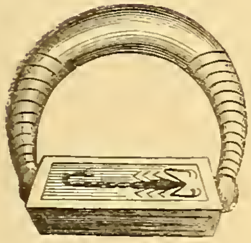
This was the issue raised before Mr. Chamberlain, and if it were merely suggestive of something yet to be, it would not be worth discussion. But the principle just stated is to a great extent covered by existing legislation affecting both the watch and silver trades, and in some quarters there appears to be no unwillingness to increase its stringency. Everybody is familiar with the hall-marks on silver plate; they certify that the metal is of a certain standard. The fact is not so well known that nothing below that standard can in this country be legally sold. There is an open market for electro-plate; but if a manufacturer send to Goldsmiths' Hall an article for which, upon examination, the hall-marks cannot be claimed, it is—returned to him? Nothing of the sort! The workmanship may be rare and costly, but it will nevermore gratify the eye—the Goldsmith's company will carefully break it up and return the owner the pieces. It is unnecessary to say that this fine old custom has a very high antiquity, and that there are people who would be sorry to part with it. The position of the English silversmith presents a study in trade survivals; he is regulated in the present day as all other tradesmen used to be regulated centuries ago, and the quality of their wares guaranteed by a paternal Government. He cannot sell goods of varying standard of purity under the same responsibility as other tradesmen; his work is specially taxed, and cannot be dealt in without a special license. In the watch trade similar restrictions prevail. An English watch manufacturer must not sell a watch that has not been hall-marked. On the other hand, the Swiss competitor may and does sell in this country thousands of watches that have no such guarantee. The Swiss and Americans also sell watches that have been hall-marked, and with which English buyers appear to be satisfied! At all events, they make no complaint, and it is left to the English trade to complain. It is not pretended that there is any difference between an English and a foreign watch-case bearing the impress of the Goldsmiths' Hall, or that the investigation there made is concerned with anything but the exterior of the watch. The grievance alleged is that foreign movements are put in English-marked cases and sold as English watches. To remedy this it is proposed to refuse the hall-mark to all foreign goods, and thus to compel them to be sold for what they really are. The hall-mark, it is contended, though originally designed to certify only the purity of the metals, has come to be regarded as a certificate of origin—as, in fact, an English trade-mark. The English buyer, it is said, knows this, and while he is looking for the hall-marks he is thinking of the watch as a whole, and of the superiority of English workmanship. It is not surprising that the account given of the mental process in such transactions should be somewhat coloured by class egotism. To the English watchmaker English watches are necessarily the subject of constant cogitation; but watch buyers have little worlds of their own, and are heedless of some considerations which he very properly regards as important. The whole subject of hall-marking, as affecting both the watch and silver trades, was exhaustively investigated by a Select Committee three years ago, and there is a good deal of evidence to show that watch-buyers are not so much the victims of foreign deception as has been represented. People who give several pounds for a watch expect it to be hall-marked as a matter of course, but there is very considerable testimony against the assumption that the hall-mark is taken as evidence either of the British origin of the case or of the movement. The movement, it is obvious, is the more important part of the watch, and this is sold under the responsibility and with the guarantee of the vendor. "The hall-mark is a mere nothing in comparison with the name of an English watchmaker on the back of the watch or case"—this is the burden of much evidence from experienced manufacturers and dealers. Nor does it appear that it is an easy matter to draw the line between an English and foreign watch movement. There is a very considerable importation into this country of foreign watch movements, which are worked up into English watches in various ways, and in varying proportions. Some gentlemen from the provinces, who were examined by the Select Committee, were not afraid to suggest that the hall-mark should not only be withheld from foreign watches, but that it should be made a punishable offence to use foreign movements for hall-marked cases, whether English or foreign. The same zeal was not shown for the protection of the public against an artifice by which watches emanating from Liverpool and Coventry were, for their more ready sale, passed off as London watches. It was philosophically suggested that nobody but an expert could tell the difference, and it need not be doubted that general ignorance on this point adds to the sum of human happiness.

No impartial student of the report and proceedings of the Select Committee can doubt that the grievance set up by a certain portion of the watch trade is of the protectionist order. Of course, protection is disclaimed, but where in these times is the protectionist who will frankly own that he wants protection? He wants something which perverse opponents will persist in calling protection, but with whose true character he is best acquainted. As regards both the watch and silver trades, what they stand in need of is freedom, not restriction. Hall-marking has its value, but it is obviously a regulation in restraint of trade. There is a strong feeling in its favour among certain manufacturers, and there is no reason why it should not be gratified. But there is equally good reason why the hall-mark should not continue to be compulsory, either for plate or watches; it is a relic of public functions which in far different times embraced all kinds of industry, and which only a superstitious regard for the "precious metals" has preserved in its now limited sphere of operation. There is much contempt among English watchmakers for "cheap foreign rubbish," but it is certain there is a great

Supplement to the Watchmaker, Jeweller, and Silversmith, December 5th, 1881.

ANTIQUE RINGS AND ORNAMENTS.

EGYPTIAN.



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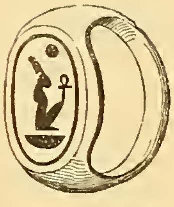

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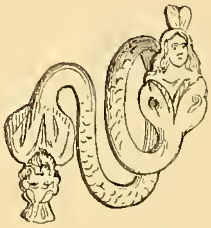

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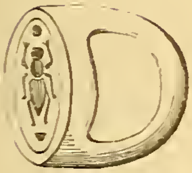

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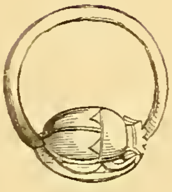

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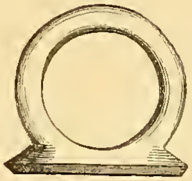

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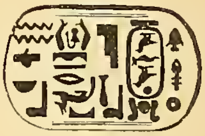

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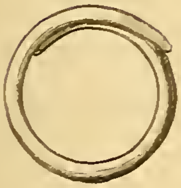

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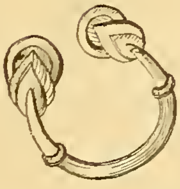

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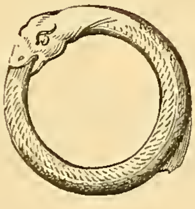

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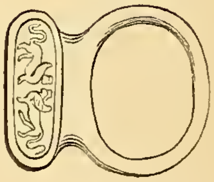

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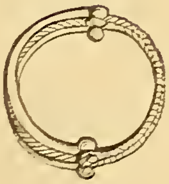

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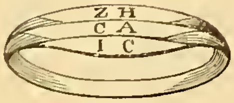

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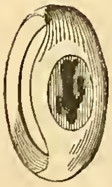

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home demand for it, and there is qualified opinion to support the suggestion that the English trade would do well to be less indifferent to the wants of humble buyers. English watches have their merits, but they have not the merit of being cheap, and, as Mr. Edward Rigg has hinted in his recently published Cantor Lectures. it may be questioned whether the average English watch is so much superior to the average foreign watch as to justify the marked difference in their prices. But for the necessity of hall-marking, we may believe that English makers would long ago have entered into a more thorough competition with their foreign rivals; and hall-marking must be made voluntary before the competition can be equal. Doubtless there are English watchmakers who hug their chains, and who think it a great advantage to be prevented by law from selling anything but a gold or silver watch. It is from such quarters that the cry against unfair foreign competition proceeds. The competition of the foreigner may not, indeed, be fair; but the foreigner has something to say for himself, and it cannot be denied that he has watches to sell which the English public persist in buying. It is for English watchmakers to consider whether it would not be better to fight him in the open market, rather than by fresh legal restrictions, for which Parliament will be appealed to in vain.

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Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

(Specially Translated and Revised for this Journal.

(*Continued from page* 73.)

No. XXXI.

Preparation of Bisulphate of Soda for Cold Silverings.—Put into a tall vessel of glass or porcelain, water 10 pints, crystallised carbonate of soda 10 lbs.; pour a little mercury into the bottom of the vessel, so that the glass tnbe carrying sulphurous acid gas, which has to be placed into it, may not be stopped by the crystals formed during the operation. Arrange an apparatus for the production of sulphurous acid gas, and let the washed gas pass through the vessel holding the carbonate of soda. Part of the soda is transformed into sulphate of soda, which dissolves, and a part falls to the bottom as bicarbonate. The latter is, however, transformed into sulphate of soda by a continnous production of sulphurous acid, and the carbonic acid escapes. When all has dissolved continue the passage of sulphurous acid until the liquid slightly reddens blue litmus paper, and then put the whole aside for twenty-four hours. After that time some crystals are found upon the mercury, and the liquid above, more or less coloured, is the bisulphite of soda for silvering. The crystals are separated from the mercury, drained, and kept for gilding baths. They are not suitable for silvering. The liquid bisulphite of soda, thus prepared, should be stirred with a glass rod, to throw off the carbonic acid which may still remain. The liquor should then be again tried with blue litmus paper; if it turns a deep red, add a little carbonate of soda for neutralizing the excess of sulphurous acid; if red litmus paper becomes blue, there is too much alkali, and more sulphurous acid gas should be passed through the liquid, which is in the best condition when litmns paper becomes violet or slightly red. This solution marks from 22° to 26° Baumé, and must not come in contact with iron, zinc, tin, or lead.

Cold Silvering Bath for Dipping.—A stoneware or glass vessel is about three-parts filled with the liquid bisulphite of soda, a solution of nitrate of silver in distilled water of medium concentration is gradually added, while the bath is continually stirred with a glass rod. A white flocculent precipitate of sulphite of silver is produced by stirring; this is dissolved by the bisulphite of soda. The silver solution is added so long as the precipitate readily disappears, and stopped when it becomes slow to dissolve. This bath is always ready to work, and instantaneously produces a magnificent silvering upon copper, bronze, or brass articles which have been thoroughly cleansed and passed through a weak solution of nitrate of binoxide of mercury, although this last operation is not absolutely necessary. According to the length of time of the immersion the bath will give, a very fine whitening by silver is as cheap as any of the other described processes. A bright silvering specially adapted for setting jewellery, or a silvering with a dead lustre, still more durable, without electricity, and in the cold. The loss of silver is made good by additions of nitrate of silver. When the proportion of bisulphite is not sufficient to dissolve the metallic salt, add some bisulphite of soda to restore the bath to its primitive state. Silver is slowly deposited upon the sides of the vessel: this may be dissolved in nitric acid for further use.

Solution of Silver or Gold for Silvering or Gilding without the Aid of a Battery.—1 oz. of nitrate of silver is dissolved in one quart of rain or distilled water, and a few crystals of hyposulphite of soda are added, which form a brown precipitate soluble in a slight excess of hyposulphite. Small articles of steel, brass, or german silver may be silvered by dipping a sponge in the solution, and rubbing it over the surface of the article to be coated. A solution of chloride of gold may be treated in the same manner, and applied as described. A more concentrated solution of either gold or silver may be nsed for coating parts of articles which have stripped or blistered, by applying it with camel-hair pencil to the part, and touching the spot at the same time with a thin clean strip of zinc.

Silver Electro-plating Bath.—

Water........................	2 1/5 galls.
Cyanide of Potassium, pure....	17½ oz.
Pure Silver for Cyanide	8¾ oz.

The composition of commercial cyanide of potassium is exceedingly irregular. The pure, or No. 1, contains from 90 to 100 per cent. of real cyanide, and is especially employed for gilding and silvering baths. No. 2 contains from 60 to 70 per cent. of real cyanide; it is the article prepared by Liebig's method, and is used for electro-baths of copper and brass. No. 3, which marks from 55° to 60°, is for scouring and preparing baths, and for photographic operations. (1.) Pnt in a porcelain dish, holding a qnart, pure granulated silver 8¾ oz., pure nitric acid at 40° Baumé, 17½ oz. Heat by charcoal or gas. The dish should be supported by an iron triangle, and not in direct contact with the fire. The acid rapidly attacks and dissolves the silver with an abundant production of yellow nitrous vapours, which must not be inhaled. When the vapours have disappeared, there remains a liquid more or less colourless, according to the proportion of copper held by the commercial silver, which is seldom entirely pure. The heat is then increased in order to evaporate the excess of acid, which escapes in white fumes. The material in the dish swells up and dries, and, with a further increase of heat, melts like wax. The dish is then removed from the fire, and being held with a cloth, the molten mass is made to flow upon the sides, where it soon solidifies. The fused nitrate of silver, lunar caustic, is more or less white or grey, according to the purity of the silver employed. When perfectly cooled, turn the dish upside-down, and by a gentle tap on the sides the mass is detached. (2.) Dissolve the nitrate of silver in ten or fifteen times its weight of distilled water; hydrocyanic acid poured into this solution immediately produces an abundant white precipitate of cyanide of silver. A sufficient quantity of prussic acid has been employed, when, by adding a few drops of it to the clear liquid, no precipitate or solidity appears.

(*To be Continued*).

Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann on Monday Evenings, from October 25th.*

(Continued from p. 81).

METHODS OF SETTING OUT THESE ESCAPEMENTS.

THOUGH it would be possible, from the texts to the illustrations, to form the escapements, yet a few supplementary explanations may be desirable to some.

Fig. 37.

Draw a circle representing A B, and divide it in 30 equal parts. Draw the arc for the depth of the teeth, which need only be deep enough to keep the pallets free of the bottom, for the purpose of having the teeth as stable as possible. No rule need be specially observed for the inclination of the teeth; if the escape-wheel were reversed it would not alter the conditions of the action. On the contrary, it would require less drop, and in softer pallets reduce the wear, because the pressure would be distributed over a greater surface.

Take any tooth *c* and erect a line at right angles to its radius W *c*. Also take any point, c^1, c^2, or c^3, according to the span, being the middle between one tooth and the one nearer the centre over which the pallet has to span, and erect a perpendicular to the wheel radius to this point; then where they cut each other will be the centre of the pallet; thus, *g*, *h*, and *k* are the centres of pallets spanning over five, eight, and ten teeth. Mark off an angle with $g\ c = 4°$, or equal to the impulse angle the pallet is to have $= c\ g\ o$. Determine *d*, the distance of which, from the central point of two teeth on the periphery or arc drawn through the points of the teeth, is the measure of drop, which may be from ½ to 2°, according to the quality of the wheel. With *g* as centre, and *g d* as radius, draw an arc cutting *o g*, join this new point with *c*, which gives the driving plane. A similar method is adopted with the opposite pallet P. Mark off the distance for drop from tooth *a*, and draw a line through this point from *g*, and draw an angle with this line from centre *g* equal to the impulse angle on the corresponding pallet, then with centre *g* and $g\ c^1$ as radius, bisect $g\ o^1$, join these as described, and *r s* will be the impulse plane on this pallet. The inclination of *s e* has to be determined according to pre-determined rule, as described before.

The same process holds good for the dead beat, Fig. 44. The arc *o d* is drawn with radius C *o*, and the inner arc with a radius corresponding to *g c* (Fig. 37). There is one exception we need point out. The arc leading off from *c* should be just within the periphery of the wheel, so that when the delivery edge *r* of pallet *p* (Fig. 37) becomes disengaged, the tooth *c* rests fairly on this locking arc.

The Pin Pallet Escapement. Fig. 47.

The inclination given to the face of the teeth forms the measure of the recoil, which is a point to be considered, as stated before. The measure of half the chord of the pallets *t r s*, is determined by the impulse angle, and the measure of *o e* is equal to half the span of two teeth, less the drop.

Through a point in the periphery, corresponding to *d* (Fig. 37), and parallel to the wheel radius, draw *s t*, and make *e s* equal to the chord of the impulse angle. Describe an arc about the three points *t o s*, and it will give the form of the pallet. The same holds good for the opposite pallet *p'*, except it has to be drawn so that the point *s* lays in the periphery of the wheel, instead of point *o* of the opposite pallet *p*.

The material forms of the pallet frame can be determined according to the artistic fancy of the designer. The law of inertia demands, however, to give it no more "mass" than stability requires.

Pin Wheel Escapement. Fig. 48.

Lay out the 30 divisions on a circle, of which A B is a section, these divisions being points *o* on the semi-circular pins $a\ a'\ a''$.

The strength of these pins should be no more than stability requires, on the rules of which we cannot treat now. Take any centre C on a line drawn at right angles to the wheel radius of point *o*, tooth *a'*. With this line and centre C mark off the impulse angle, plus half the chord or diameter of a pin, or the $\angle\ o\ C\ k$, *o* C being just touching the outside of pin *a'*. The locking arc of pallet P' is drawn with a radius equal to the distance of centre C from a point in the periphery A B, which lays midway between the face of pin *a* (measured on the arc A B) and the back *o* of tooth *a'*, and the breadth of each pallet is half the space contained between two pins minus the drop. The impulse on pallet *p* is determined by an angle of equal measure with *m* C. It will be observed that the real impulse angle is the measure of *m* C *n*, or *o* C *k*, plus an angle whose chord is half the breadth of a pin and radius C *d*, pallet *p'*, and radius C *b*, pallet *p*. Therefore, the two impulse angles can never be quite equal, the measure of the inequality being the ratio of locking radius; but practically this has no influence.

THE HORIZONTAL OR CYLINDER ESCAPEMENT.

The principles which determine the impulse movements, and the resistance to the moderator in clock escapements, are those which are employed in the horizontal escapement, but they appear in a modified form. The lever and inclined plane are the agents for maintaining the motions of the moderator, but in the one in question they are applied in a reversed order.

In the clock escapements we have had under consideration, the wheel radius of contact is constant during impulse and repose (with a very unimportant exception in the pin wheel escapement), while the pallet radius of impulse contact varies, because the inclined plane or wedge is attached to, and moves concentric with, the axle of the pallets, and the point of application of the circumferential force of the wheel moves nearly in a line with this pallet centre.

In the horizontal escapement we have the radius of the outer and inner surface of the cylinder, corresponding to the radius of locking in the dead beat escapement (Fig. 44), but the inclined plane is formed by the tooth, and therefore we have a constant radius of rest, and a variable radius of impulse contact in the escape-wheel, the former corresponding to the radius of the periphery of the clock escape-wheel, and the latter to that of the pallet impulse contact.

The cylinder radius of impulse is nearly constant, and may be considered so for all practical purposes; likewise, the impulse or lifting angle to a given wheel. With a wheel of a given radius of its periphery, and a given cylinder angle of impulse, the geometrical conditions make the height and angle of the incline subject to the thickness of the cylinder. By the term "thickness," we understand the measure of the difference of the radii of the inner and outer surface of the cylinder, or the solidity of the shell. A circle whose diameter represents both the length of the incline of the tooth and the space between the heel of a tooth and the point of the adjacent one, must be an imaginary line; hence the thickness of the cylinder is the measure of the departure on either side of this line; that is, half the thickness falls within, and

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half outside of this circle. But the diameter of the circumference of the cylinder determines the necessary space between the heel of one, and point of adjacent tooth; hence, as to a given wheel, the distance of two adjacent heels is a constant quantity, it follows that the increase of space must diminish the length of the incline or driving plane of the tooth.

In equal angles the arcs vary as the radii, and with constant arcs the angles vary inversely as the radii. Therefore, the cylinder angle of impulse being a given quantity, the lifting arc must vary as its impulse radius. But the lifting arc of the cylinder is synonymous with the height of the incline, which varies as the radius, and the length of the driving plane inversely as the impulse radius of the cylinder, as we have shown: hence it follows, that increase in the thickness of the cylinder implies a shorter driving plane, and a larger inclination of the driving plane with the direction of the circumferential force of the escape-wheel at the point in contact. But the angle formed by the driving planes of the wheel, with the direction of rotary motion of the cylinder, which is represented by the tangent to the cylinder radius of contact, determines the impulse moment. Just as in the clock escapement, the angle formed by the direction of the circumferential force of the escape-wheel with the driving plane of the pallet determines the moment of the pallet, but in a reverse order: that is, in the clock escapement the circumferential force of the escape-wheel is represented by the weight (Fig. 23, page 130, Vol. VI.), and in the horizontal by the power: hence, in the former case, the moment varies inversely as this angle, and in the latter proportionately to it. These conditions appear to present some complication, but we will make them as plain as we can.

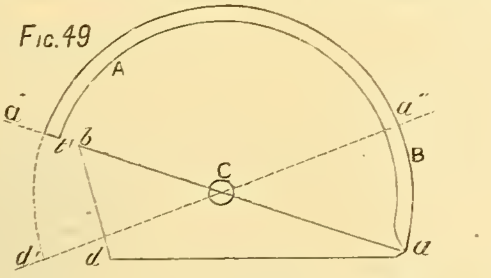
ANGULAR MEASURE, OR OPENING OF THE CYLINDER AND FORM OF THE LIP.

It is necessary to ascertain the conditions to be satisfied on these two points, before we can determine the impulse radii of rest.

By the opening of the cylinder we mean the amount by which the section of the cylinder that is in contact with the escape-wheel falls short of a complete circle. This amount is generally negatively stated: that is, for instance, the angular measure of the half shell is given, and thus we infer the amount that is cut away. Saunier gives the first as 196°, therefore the latter must be $=360° - 196° = 164°$.

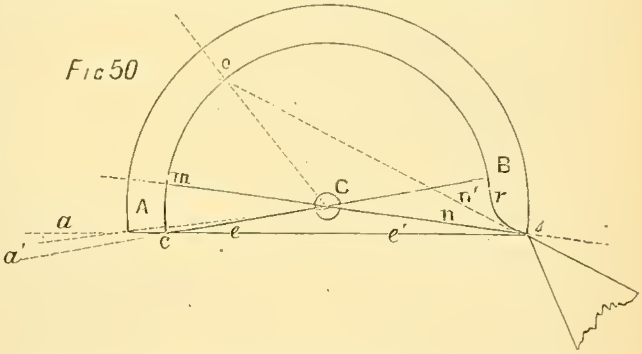
We can easily show that the conditions to be satisfied lay within a few degrees of this measure as the limits. We shall find that it is desirable to have the driving plane as long as possible, consistent with sufficient clearance or play; therefore, it is equal to the inside Diameter of the cylinder minus the shake or play. But 180° of the cylinder represents the diameter of the cylinder, and, therefore, if an angle formed by the radii drawn to the termination of the inner and outer circular surface is much less than 180°, then the tooth could not enter, but would have to be equal to the chord of this arc. In the other direction we have the banking setting the limit on one side, and the necessary stability of the banking slot on the other. That is, if the angular measure of the half shell is below the amount given, we should have the pin in the balance knock the banking on the least exceptional vibration, or have it over bank.

Fig. 49



Let A B, Fig. 49, represent the cylinder cut away to 180°, and let $b\,a\,d$ represent a tooth of the escape-wheel, then it is evident, since the length of the incline approximates to the diameter of A B, the middle of the plane $a\,b$ must very nearly coincide with the centre C of the cylinder, and, therefore, if t represents the position of the point where the heel leaves the cylinder, a is that where the point of the tooth makes contact, and suppose that $a'\,c\,d'$ is the impulse angle of the cylinder, then a'' is the position where the heelof the tooth leaves the disengaging lip. Let $\angle\, b'\,\mathrm{C}\,d' = a\,\mathrm{C}\,a''$, then this motion of the cylinder will bring a' to d', and $\angle\, a''\,\mathrm{C}\,d'$ will be the uttermost extent of the semi-vibration of the balance. Deducting from this the measure of the thickness of the pin (equal to half the one in the balance, plus half the other) and the necessary freedom, we have less than 180° on one side, and, therefore, the two lockings could not be set on opposite points of the circle. It is evident, therefore, that the measure given by Saunier is correctly the minimum. The lips of the cylinder, that is, the terminal edges of the shell, should be so formed that the plane of the tooth makes contact immediately the point passes off the circular part of the shell without drop, and leaves the engaging lip at a point close to the inner surface of the cylinder, and the disengaging lip at a point close to the outer surface, otherwise the drop will be augmented by the distance of the points of disengagement from the inner and outer surface of the cylinder. Suppose both lips are parallel to the chord of the shell of the cylinder, then on the engaging lip we should have this condition satisfied, and on the disengaging the heel of the tooth would remain in contact with the inner edge, and the drop would be supplemented by the full measure of the thickness of the shell; therefore, the form with the edges rounded will be the one for the engaging lip; but for the disengaging lip some form must be adopted, so we obtain the same result as on the engaging lip.

Fig. 50



Let A B (Fig. 50) represent the shell of the cylinder, of which A is the engaging, and B the disengaging lip. Therefore, a line $e\,e'$ joining A B would represent a chord of 180°. Then, if the lip A is parallel to, or a section of, this chord, and the diameter of the cylinder represents, approximately, the direction of the plane of the tooth, then it follows that the face of this lip makes an angle with the incline equal to $a\,c\,a' = \frac{1}{2}\ 180° - (360° - 196°) = \frac{1}{2}\ 180° - 169° = \frac{1}{2}\ 16° = 8°$; therefore, the heel of the tooth must remain in contact to the inner surface of the cylinder, and only the corners need be rounded as indicated. Again, $m\,n$ represents the direction of the incline of a tooth at the commencement of the impulse contact on the engaging lip, and offer a lifting angle of $40° = m\,\mathrm{C}\,o$. $o\,n'$ represents the direction of the driving plane; therefore, $r\,s$ must be the form of the disengaging lip, to satisfy the condition we have stated.

(*To be continued.*)

The Story of a Presentation Watch,

AS TOLD AT THE JAW-MUNDUM CLUB.

By C. Stuart Murray.

NIGHT THE THIRD.

"Attempt the end, and never stand to doubt."

MATTERS seemed to run pretty smoothly between October and February, when I had to go on the year's balancing journey—the longest one that I had throughout the whole twelvemonth. On the second week I was in Derby, having to call upon Mr. Webb, whom the company have met before in this story. He had been advised of my coming, and had invited me to his house. The very first morning in the hotel, I found that the watch had stopped. What was to be done? A watch I must have, if I sent home for one. Whilst my breakfast was being got ready, I went out and telegraphed: and the next day's post brought me relief. I had never mentioned a word about my misfortunes in this way to any of the committee of the Presentation Fund. But now that I was going to call upon the vice-chairman, I intended to "unbosom" myself. I was introduced to Mrs. Webb and a one o'clock dinner: but almost the first question that I was asked, was—"Well, how does your watch get on?" I at once told him the whole history of it, as I have told you gentlemen here. He expressed himself as very much amazed, and said that he would have it inquired into, as to why such a man came to be employed in the matter at all. When I returned to town, I immediately hastened off to my old watchmaking friend.

"Halloo!" he exclaimed, as he looked at it after taking it out of the case. "Why, who has been at this watch?"

I told him that I had paid him 35s. for "making good all defects," as he wrote on the bill, and they were not made good yet. He then tried the escapement.

"Why," said he, "this 'scape-wheel trips. How much a day has it been gaining?"

I replied that I did not know; for it was such a blessing to have it going at all, that I took no notice about either its gaining or losing.

"Ah," he resumed, while taking it to pieces, "you had better have followed my advice a twelvemonth ago and sent it into the sale-room."

"Well, no; I'll see the play out, now, as I have gone so far."

"These pallets," he said, "have been ground to the stumps; and even to make a patch-up you must have a new pair; and then sell it, pawn it, *give it away*, and let me show you the kind of chronograph that I can turn out for you for less than that cost, I know?"

Well, he put a new pair of pallets in, was paid for them, and I came away. "At last," said I to myself, "I may make it do." I was getting along comfortably enough, and on one of my journeys had occasion to call upon a large watch manufacturer who had invested in our business, we having become a Limited Liability Company. He had heard about my presentation, and drawing a tray full of gold watches out of a safe in his private room, he took up a chronograph and asked me if mine was "anything like that?" I responded by taking mine out of my pocket and laying it beside him on the table. He remarked that it was very dirty; when I answered that, to my certain knowledge I had paid for no fewer than three cleanings within the twelvemonth. He looked at it again, and said:—

"Why, this bezel is too flimsy, and does not shut down closely enough."

I added that it had been only recently knuckled to make it fit.

"Knuckled," he echoed; "it is only fit to be weighed into the melting-pot."

And then he turned the case over, and told me that the dome did not cover in properly. I droned out ruefully, that the watch had cost me a deal of money, and I thought of sending it into the sale-room. But what was the remedy?

"There was no remedy," he answered, "but making a new dome and a new bezel. Leave it with me, and I'll get my foreman to put it in hand."

I left it, and in course of conversation he said, "What a pity that you did not have the order sent to me, or to some respectable maker whom you knew."

I replied, that the order was left to the Presentation Committee, and one of them recommended what he called a "first-class man," who, upon inquiry, turned out to be a joint finisher.

"What did it cost?" he asked. I told him.

"Good gracious! Why that is several pounds more than you would have given for any chronograph before you. They are all of the very finest make possible; nay, furthermore, I can give a guarantee of quality for twenty years, if you like, and the weight of the case will be stated on the invoice. Contrast that with the tinpot thing that has been palmed off upon you."

Well, I did contrast it, and I did not feel very lively under the operation.

In bidding me "Good bye," he added, "You know that we have got something of a reputation in London that is worth preserving." And the firm has, without any qualification whatever; and a very high reputation, too.

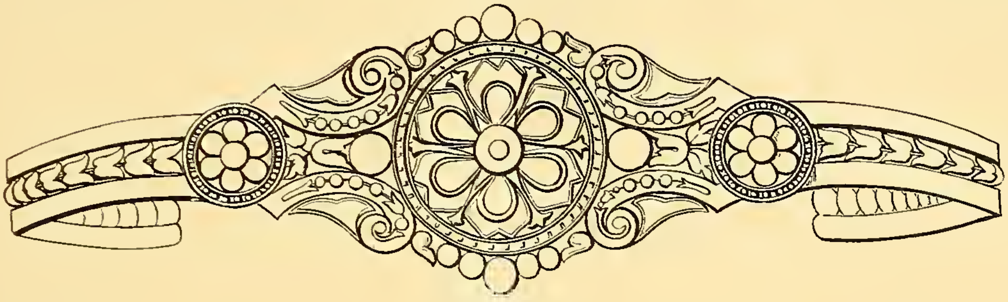
In the course of a fortnight, he wrote to me to say that it had been reported to him, that with a new fusee and chain, a new third wheel and pinion, new hands and re-jewelling, and the balance—I call it balance-wheel—finished off, and a new set of hands, the watch would do. It was also intended to put a quicker motion in, what he called an 18,000 train, so that the seconds and minute-hands should coincide. The so-called jewels were mere rubbishy garnets, "as soft as rottenstone," and therefore, no good. That was to be done.

It was in hospital again for nearly two months, and when it came home, a catalogue of its ailments and *healments* accompanied it, together with a *rate of its going for five weeks!* That rate was a gaining one of a little over a second a day. Mercy upon us! Have we reached the end of our journey at last? I was not slow in telling my friends of the great change that had happily taken place. But my joy was to be short-lived. On the very third morning after that, I looked on its "sweet face" as I was dressing myself, and—did my eyes deceive me?—it was stopped! I took it in my hands, half stupefied, and lo, it began going again. I at once concluded that it wanted winding up—which it did, as that was near the usual time,—and I wound it up accordingly, and set it to time. It went very well all day; and by way of a change, I left it in my waistcoat pocket when I undressed for bed. Several days having gone by and no disturbance, I thought that I would return to my regular plan of laying the watch flat at night.

"Why flat sir?" said a listener; "for I have been told that a watch should be in the same position at night as in the daytime."

"So have I been told," replied our friend; "but several of the highest watchmaking authorities of this country have said the contrary. That by changing from the wearing position to the flat, you change from the sides to the ends of the pivots, and thereby reduce the friction, by its transference to a much smaller surface, as will be readily understood. You also set up an equalisation of rate, or the basis for an equalisation of rate, that could not be got in any other way.

MONTHLY SUPPLEMENT OF DESIGNS.



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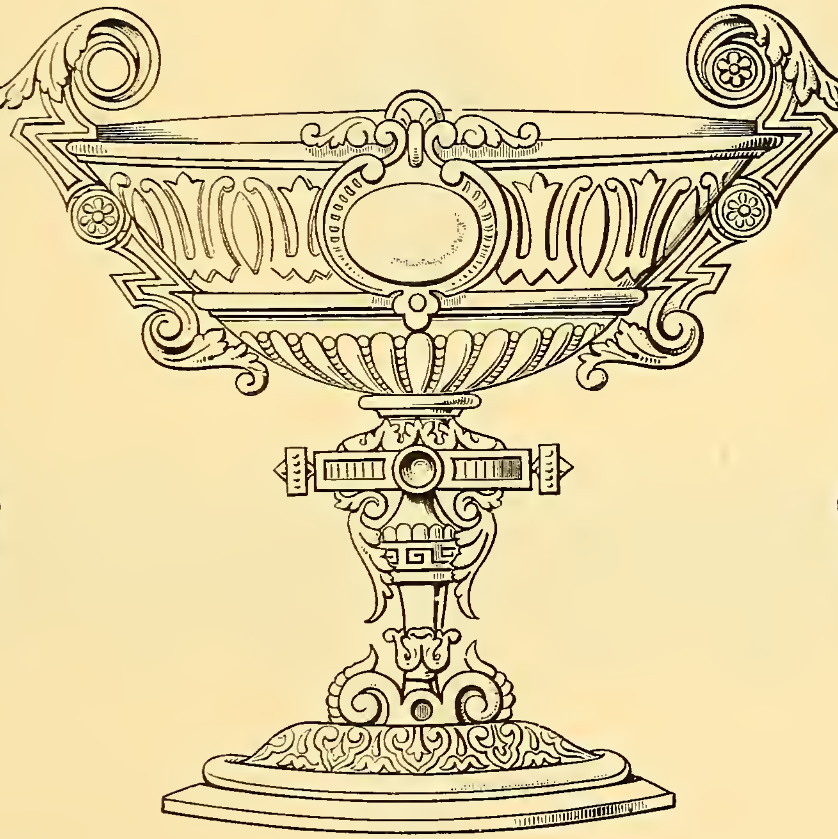

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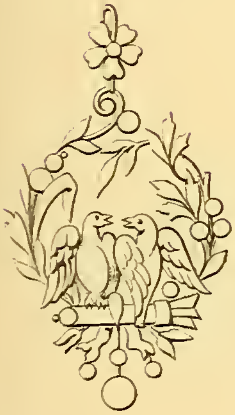

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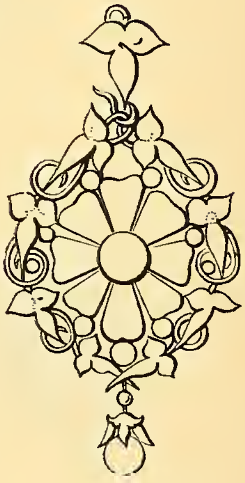

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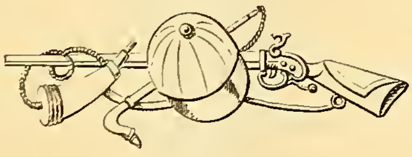

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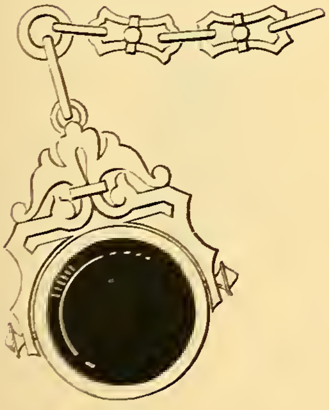

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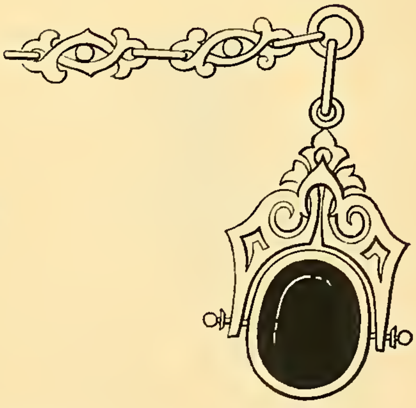

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PARISIAN NOVELTIES.

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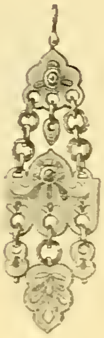
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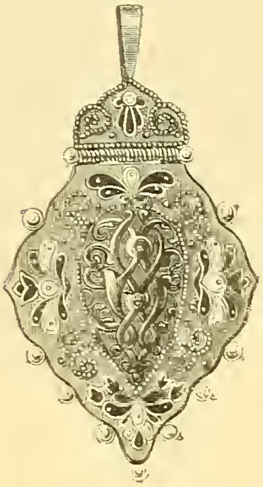
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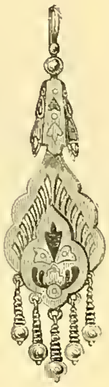
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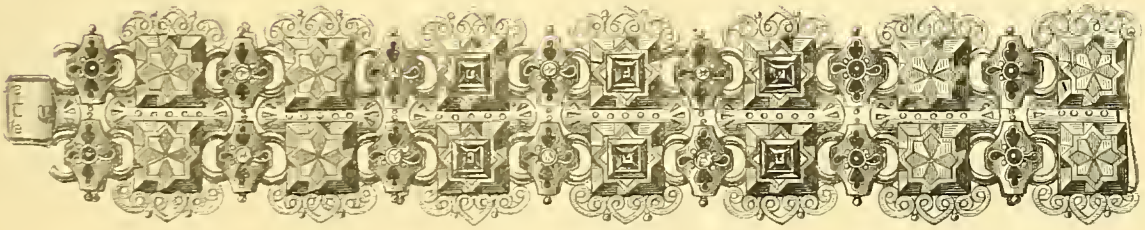
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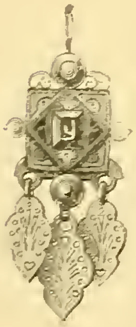
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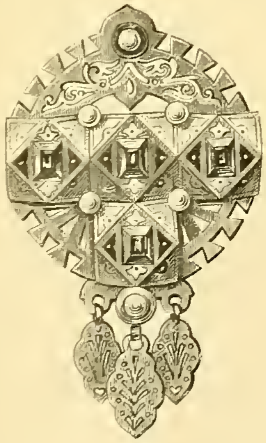
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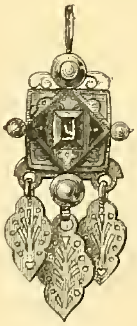
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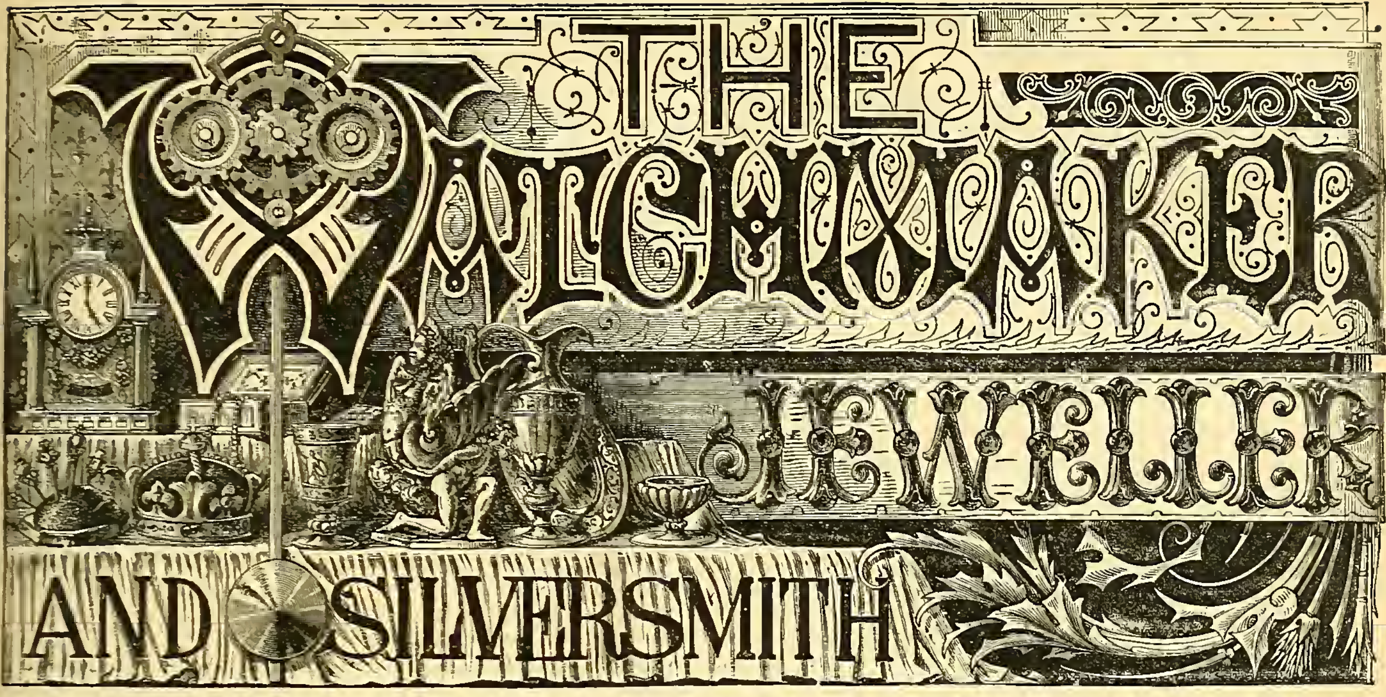

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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TWO ILLUSTRATED SUPPLEMENTS :—1. Designs for Modern Jewellery. 2. Antique Rings and Ornaments.

No. 80.—Vol. VII.] JANUARY 5, 1882. [Subscription, 5s. per Annum. Post Free.

The Future of the English Watch Trade.

By James U. Poole.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—In commencing this paper, I cannot refrain from taking the opportunity of expressing the wish that the year 1882, on which we have now fairly entered, may prove a prosperous one to the many subscribers to this Journal; and I do this with the more pleasure because there are evident signs of an improvement in the legitimate English watch trade. It has, unfortunately, been too much the custom of late years to speak of this industry as a thing almost of the past, whereas I believe that our American and Continental competitors will find that this is altogether erroneous, and that Englishmen still possess the faculty of not knowing when they are beaten, whether in watchmaking or any other competitive undertaking. I hear that extraordinary efforts are being made in the provinces to produce watches which shall supersede foreign productions in the colonial markets; and with the facilities which we possess for obtaining labour of every description, we ought to be able to follow this up by competing with Swiss watches in America. Three years ago it was stated that the programme of the American watch companies was to entirely crush the Swiss industry. This they have not succeeded in doing, for the value of the Swiss watches exported to America in the year 1880, according to the *Swiss Horological Journal*, is nearly double that of the year before, and nearly treble that of the year following the Centennial Exhibition, when the Swiss manufacturers were supposed to be thrown in a state of utter consternation by the report of their representative, M. Favre Perret.

"What man has done man may do," says an old proverb, and in spite of the statement in an American Horological Journal, that the American watch factories are now producing *four watches a minute*, with power to add to their number, it seems that some systematic effort ought to be made to place low-priced English watches on the American market. The Swiss have hitherto gone on the principle that "Union is strength," hence, I believe, their success. Thus, in New York there is a "Swiss Importers' Association," whose business it is to watch the interests of the trade, maintain advertisements, and make suitable replies to their energetic competitors. To this system they owed their success at the Melbourne exhibition, preferring to merge individual distinctions for the sake of the national prestige and honour. The Swiss have the great advantage of being credited with being the real manufacturers of what they sell, whereas the trade of this country has unfortunately fallen into a very unhealthy condition, there being a suspicion as to the origin of all cheap watches exported. Thus, I have myself inspected watches professedly made in this country by machinery, and am satisfied that the train wheels and escapements were foreign. This is perfectly well known to American buyers, and they not unnaturally prefer to deal directly with the Swiss manufacturers. Nothing short of a national watch factory of sufficient importance to attract the notice of the world would establish the credit of the English manufacture in low-priced watches in the United States; and, as I have already stated in the conclusion of my paper on "Machine Work *v.* Hand Work," such an institution would benefit the high-class trade, by acting as a general advertisement for English productions. For the present I leave this topic, which will be referred to again in a future paper, and now desire to assign a few reasons for the unusual depression which has existed for some years past among the manufacturers of fine watches, and which the return of the usual seventh year of improvement in the trade of the country (1880) failed to remove. Without doubt the times *have* been bad; many middle-aged men have turned their attention to jobbing and repairing, while younger ones have left it in utter disgust, the result being that referred to by Mr. Rigg in his lecture at the Society of Arts (Feb. 21st) last year, viz., that "practically the whole of the best work of Clerkenwell is now performed by men advanced in years."

It is a singular but undoubted fact that very few of our leading horologists have sons who are capable of carrying their businesses on in the same manner as themselves. The majority of them swell the ever increasing army of "middlemen," and having no producing powers of their own, are compelled to trade in ready-made articles, thus directly encouraging the importation of foreign goods and rendering it more difficult for skilled workmen to obtain employment. Their fathers, for the most part, were self-educated and self-made men—men who applied themselves to the acquirement of knowledge for the love of it, and did not allow its possession to unfit them for their daily routine of mechanical toil, such as described in my earlier contributions to this Journal; but the finer perceptions which were awakened in their natures by the acquirement of knowledge, coupled with the increasing refinement of the age, caused them to show a mistaken consideration towards their descendants who despised the practical part of the business as something beneath them, thus furnishing an additional proof of the truth of the line, "A little knowledge is a dangerous thing." Only *thoroughly* educated men fully appreciate the dignity of labour, and I look forward to the time when a great improvement will take place in this respect, but at present the first impulse of our educated youth is to obtain some employment which is no trouble to learn, and for which they will receive payment at once. Thus, only the other day a youth who under former conditions would have been a watchmaker, applied to me to fill up a form of recommendation prior to passing an examination to enable him to enter the telegraph office, the said examination consisting in writing from dictation, handwriting, and working easy sums in the first four rules of arithmetic. After a month's practice in working the instrument, he expects to receive 12s. per week, possibly 16s., with advances of £5 per annum until the sum of £65 is reached. Contrast this with the uninteresting drudgery of watchmakers' apprentices, and it is no wonder that intelligent youths should regard it with aversion. I, however, predict that a few years will be sufficient to completely glut the market with such youths, and then the mechanical trades will again be looked upon with favour.

The various means of obtaining theoretical and practical acquaintance with the principles of Horology will be invaluable for the training of those who are unable to go through a proper form of apprenticeship, and will thus be instrumental in preserving the industry to the country; but, at the same time, I do not believe that good workmen can be manufactured to order, and no theoretical acquirements will ever supply the place of practical skill. I can illustrate this by referring to near relatives of my own, one of whom in particular executed better drawings at the Horological Institute than had ever been done by any member of the family, and yet was totally deficient in practical ability, the result being that other occupations have been entered into. Of course all the above causes have partly tended to paralyse the manufacture and to prevent its being carried on with the energy that it really demanded; but it has not been an unmixed evil, for many incompetent workmen have in the meantime found their level and been weeded out of the trade. Fair competition is always a healthy thing for a trade in the long run, although its effects are not pleasant at first, and the manufacturers of fine watches are now fully aware of the fact that their productions can only hope to find favour on their merits, and not merely on account of the names they bear.

Much of the recent depression is to be attributed to the fashion which has prevailed among well-to-do people of wearing cheap watches. To quote the words of a friend—"they buy them like boots and shoes, and when the expense of repairs exceeds the original cost, they throw them aside and purchase others. This fashion will change, indeed, it *is* changing, and it may not be inappropriate to bring this paper to a close by repeating the words of an American gentleman, which fairly represent the feeling of many intending buyers. I recently met him in Edinburgh, and after a general conversation on horological topics, he produced a silver geneva hunter, saying—"You see this watch, sir: well sir, I gave what you call thirty shillings for it twelve years ago, and it runs fairly well now. I catch my trains with it, and get to church in time; but some day, sir, when I have crossed the Atlantic a few times more, I mean to give it away and get a fine English watch."

(To be Continued.)

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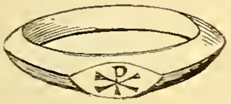
ANTIQUE RINGS AND ORNAMENTS.



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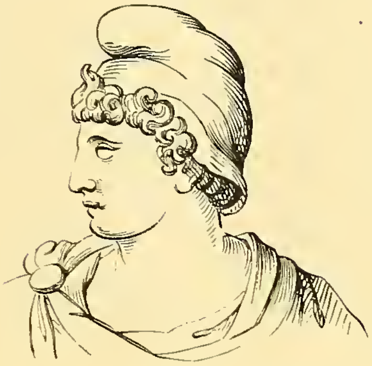

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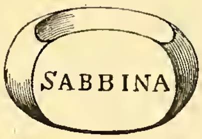

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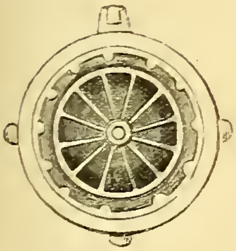

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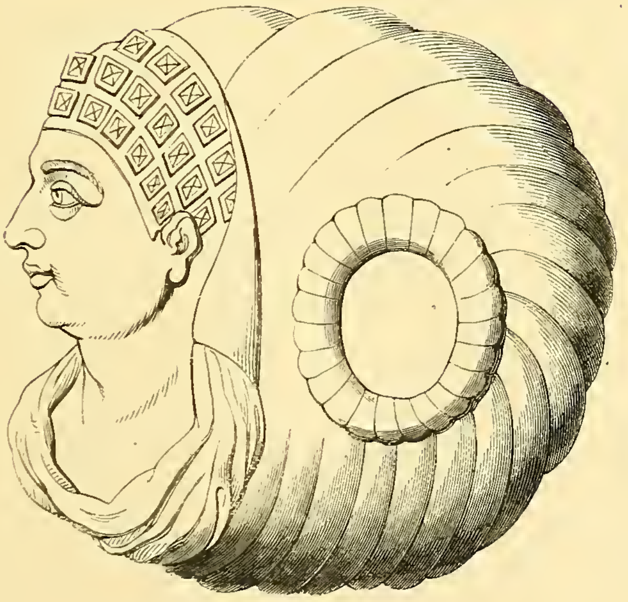

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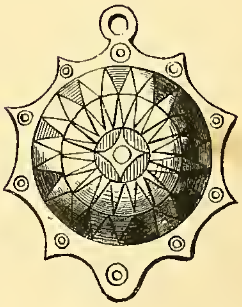

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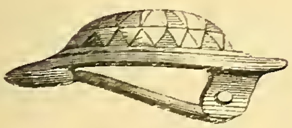

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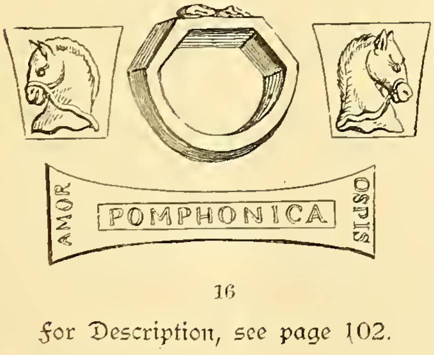
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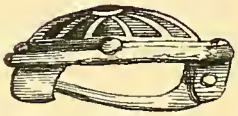

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For Description, see page 102.

The Relation of Barrel and Spring.

THE question which often appears on the surface of the daily experience of watchmakers is: "How to select a spring to a given barrel, in strength and length, that will develop the greatest energy over the longest period?"

In the inquiry for the best practical answer to this question, certain datas have to be accepted as a unit. In every barrel, the space or annulus contained between the barrel-arbor and rim of the barrel is the path over which the action of the spring occurs, and within certain limits we have the option to dispose of strength and length of this action. If we represent the available space as a sum which is made up of two factors, viz., strength and length of spring, then it is evident that this sum, again, represents the work of the spring, which will be a constant quantity, and equal to the energy into the period of rotation.

The calibre of a watch sets the limit to the rim of the barrel, and on the other side we have a boundary in the barrel-arbor. It has become quite an orthodox practice to make the barrel-arbor one-third of the barrel, regardless of the conditions of the spring. Nevertheless, the data of this measure rests on the "bending moment" of the spring, for which the diameter of the barrel has become an approximate substitute.

It is evident that the surface of the barrel-arbor forms a mould for the curve of the inmost surface of the nearest coil, whose outer surface, again, becomes the mould for the next, and so on. By an immeasurable difference, the radii of the adjacent surfaces of two coils are equal, and therefore, likewise, their circumferences: hence the variation in the measure of the circumferences is not between one coil and the next, but between the inner and outer surfaces of the same coil. This difference is the measure of compression of the inner surface, and of the elongation of the outer of each coil. It can be shown that the measure of this compression and elongation is proportionate to the ratio of the difference of the circumference of the inmost surface of the smallest coil, and the circumference of the outer surface of the largest, to the number of coils, or to the length of spring. The difference of these two circumferences is always constant for the same barrel, however we may vary the spring: whereas, by increasing the strength we diminish the number of coils, and inversely we increase them by applying a thinner spring. But half the quotient of the difference of circumferences by the number of coils, divided by the length of each coil, is the line of the angle of deflection, from which it follows that the thicker the spring the greater the angle of deflection, and that the contrary is true in a thinner spring.

This angle of deflection is synonymous with the principle of the "bending moment" of the spring, which, again, may be represented by a statical couple, whose moments are the pressure and tension of the opposite surfaces into the thickness of the spring. Hence, for equal bending moments, a thinner spring will admit of a much greater angle of deflection than a thicker one, and therefore will admit of a smaller barrel-arbor.

Since the number of turns or angle of rotation of a barrel has become almost uniform in all modern watches, and the strength of the main-spring has a definite relation to this measure and the size of the barrel, the latter has become the convenient unit for the bending moment of the spring, which is determined by the diameter of the barrel-arbor.

It is unfortunate that the conditions of bending moment clash with the angle of rotation of the barrel. If we increase the thickness or strength of the spring we require more space, or a larger path for the action of the spring, but the principal of bending-moments not only will not admit this increase, but for the sake of the durability of the spring, demands a barrel-arbor of larger diameter, and therefore curtails the space, and hence the number of barrel rotations. The dimensions of the barrel-arbor are therefore controlled by two conditions. No stronger spring than such a one whose bending moment is satisfied by a barrel-arbor whose diameter is one-third of the barrel could be used so as to get sufficient turns; and, on the other hand, few watches will admit of a spring that will warrant a departure, as a rule, in the other direction; therefore, without any further proof, we will take the diameter of the barrel-arbor in the general calibre of watches as one-third of the barrel rim (inside measure).

The question becomes now one of area, or space occupied by each coil of the spring, and appears somewhat paradoxical. If the mainspring is wound on to a spring winder whose diameter corresponds with that of the barrel-arbor, the number of rotations of the winder will equal the coils gathered up, conditional the coils on the spring are not concentric with the centre of the winder. Thus it will hold good, if the spring is straight or gathered up from a bobbin, but not when the spring is held by the hand and concentric with the winder. It is this latter condition which is identical with the spring in the barrel. If we make a slot in the rim of the barrel and gather the spring on to the arbor through this slot, we should find that the barrel-arbor would turn once for every coil it collects, but when the spring is gathered on to the arbor from the coils collected within the barrel we obtain a different result, and thus, though in the first case the number of coils on the arbor would represent the number of turns the arbor had made in turning, in the latter this assumption would be altogether misleading.

That this is so can be easily verified. If a barrel is very full, the number of coils collected on the arbor when wound up are proportioned to the length of the spring, but the number of rotations that the barrel-arbor has made in collecting them has become less as the number of coils increased.

Again, if the spring is shortened, we increase the number of rotations of the barrel-arbor as we diminish the number of coils we gather up. This increase progresses to a certain point, beyond which the decrease in the number of coils and rotations progresses in a parallel instead of an inverse ratio. It is evident, then, that whatever spring we use, there is a definite point in its length where we obtain the maximum number of rotations. In a given barrel and spring we have three quantities that determine the number of rotations, viz., the area of the space, the strength of spring, and its length. Starting with the first as a unit, we shall endeavour to determine the second when the first and third are given, and the third when the first and second are given, which will be an answer to the question heading this paper.

(To be Continued.)

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Taxation of Silver Plate.—Mr. Edward J. Watherston will read a paper before the East India Association, 14, Bedford Row, on Wednesday Evening, the 18th inst., at 8 o'clock p.m., on "Indian and other Foreign Productions in Silver, and why they are virtually prohibited from Importation into the United Kingdom." The Right Hon. Sir Arthur Hobhouse K.C.S.I., will preside.

Doctor Brochard, a member of the Société Française d'Hygiène, has lately called attention to the danger caused by wearing ornaments such as bracelets, rings, &c., which are made of celluloid, and which consist almost entirely of inflammable substances, which are said to burn like petroleum. White celluloid is the least inflammable of all. Celluloid works are placed in France among the dangerous manufactures.

The Prospects of the Silver Trade.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—We in England have recently been engaged in what may be not inappropriately described as a national stock-taking. True, it has been in a somewhat rough and informal kind of way, but we have nevertheless been enabled to estimate with sufficient closeness the net results that have followed on the great changes in the manner of conducting the national business, which began about forty years ago, amidst much opposition and many misgivings. The whole nation is but one huge limited liability company, in which all, high and low, have an interest, large or little in amounts, therefore all are personally concerned that the national enterprises should be conducted with the least possible hindrance from injudicious regulations, and that every form of industry practised among us shall have an equal chance of bringing to those who follow it a fair return for the capital, skill, and labour expended.

There have not been wanting writers and speakers in abundance, who have attempted to show that our trade has been conducted on an erroneous system, and to prove that the oftener and fuller we replenish the national wardrobe, store-room, and larder, the nearer we approach to ruin: but they have had their say and the people are not convinced; even the classes who were supposed to be most easily influenced by the will of erroneous statistics and fallacious reasonings have rejected them as unsound and misleading, and day by day the course of events forbids all expectation that our national trade policy will be tampered with in the direction of renewed protection, no matter how disguised under fine sounding epithets.

The signs of returning prosperity are now abundant and indisputable. The cotton trade flourishes once more; iron mines and manufactures are again yielding good profits and increased wages; shipbuilding is more active than at any former time, and minor trades that are influenced by the spending power of those who draw their means from the great industries of the country are also beginning to feel the benefit of the fuller supply of money coming from revived trade activity. Business men will naturally be asking themselves and others what are the chances that their particular lines shall speedily and fully share in the good times which have evidently dawned upon us.

There exists so broad a distinction between the principles under which the general trade of the country and the particular trade of the silversmith is carried on, that the question of results is at the present time even more than usually interesting; for if the national system by right, then the silver plate system must be wrong, and so on the contrary. The elaborate statistics made public on the authority of the Board of Trade can leave no doubt on any reasonable mind as to which is best, and a study of both for the last forty years will demonstrate that while the national trade and commerce have been on a continually ascending scale, with occasional temporary rests, the trade of the silversmith has been on a continually descending scale, also with occasional rests.

The spirit that animates and guides trade operations where the most advanced modern ideas have penetrated, may be illustrated from that which is as conspicuously the greatest and most enterprising of our metal industries, as silversmithing is the smallest and most stagnant.

In May of this year, Mr. J. T. Smith, the newly-elected president of the Iron and Steel Institute, one of the founders and the directing manager of the great works at Barrow, in his inaugural address summed up in these words: "It (the Institute) has broken down the spirit of exclusiveness and prejudice that is usually the most rampant where knowledge is most wanting. For metallurgical purposes it has made the world but one nation, and has thereby diffused precise and full information, not only of what our scientific progress has been in England, but of what we are, and what we lack in comparison with our neighbours."

These are sentiments such as we are fain to consider characteristic of the national tone of mind, showing as they do a full confidence in our power to meet all and sundry in fair stand-up conflict, and it cannot be disputed that our makers and manufacturers in iron and steel do carry out their enterprises wisely, zealously, and successfully, enriching themselves and benefiting the whole community, stimulating invention, and rewarding the discoveries of science with liberal hand and far-seeing confidence.

Need it be pointed out how great the contrast that exists in the spirit of those who are to the silver trade of the country what the Institute is to that in iron and steel? who meet together, not to celebrate the spirit that leads to free intercourse and good fellowship among all, wherever found, who are pursuing the object of perfecting their material and its applications, but rather to congratulate each other when by untoward circumstances much needed reforms have been postponed to a more convenient season. Nor is the contrast in the guiding spirit greater than in the results; with freedom in spirit and practice we find associated enterprise, expansion, renewed prosperity; while with the other we see nothing but stagnation and decrepitude, leaning timidly on defences that have become as worthless for modern uses as men in armour, mere lumber and encumbrance, clogging the trade effectually, and making it profitless.

The time of year is rapidly coming on when legislative changes may be looked forward to, and the question will once more be raised, whether the silver trade shall make renewed efforts to shake off that duty and those hall-marking regulations which have worked so much evil, and especially since the time when every other industry in the country was set at liberty to follow out its interests as best it may. A more flourishing state of the revenue, a President and Chief Secretary at the Board of Trade, both thoroughly alive and adverse to the present absurd state of the law, and a Chancellor of the Exchequer with whom complete industrial freedom has long been a chief article of faith, are all conditions favourable to the prospect of a change for the better. Yet the state of business in the House, and the urgency of measures of wider importance make it imperative that no pains should be spared in the effort to force into notice the peculiarly unfavourable position the trade is placed in by fiscal and legal restrictions, from which its most dangerous rivals are quite exempt.

That the agitation will be carried on as heretofore there need be no doubt. If anyone makes known to the world, by every fair and legitimate means in his power, that the trade or calling he follows is kept down by ill-advised, obsolete, and partially administered laws, he does something which is not only blameless, but praiseworthy, because he is seeking ends which will benefit not only himself, nor some small clique to which he may happen to belong, but will be of permanent advantage to all who are in any way concerned, either as producers and consumers, and following the lines of argument and action that are now proven by the incontrovertible experience of the last forty years in England to be the only ones by which the permanent prosperity of the country can be secured.

Whether the working members of the trade will pluck up heart enough to assist in bringing this long-debated question to a head in the coming year is an interesting matter for conjecture; but whether they do or not, they may rest assured that until it has been finally settled everything will remain with them in but a temporary and provisional stage. The accounts that come privately from those who have gone to the States speak of business arrangements on a scale and in a spirit of liberality which ours may emulate when emancipation has come, but certainly not till then. Everything ripens for the time when the trade shall become free; we have but to look in our shop windows to see that the artist and the machinist are doing wonders for every branch of ornamental manufacture, and new capital would gladly find a field for enterprise in so beautiful and covetable a class of wares as those in sterling silver.

It is from London that the initiative must still be looked for. Sheffield and Birmingham men are electro-platers first, and silversmiths afterwards; to them the question is not of so vital importance; they may follow, but London must lead; the very uncertainty that must pervade the trade for an indefinite time previous to the announcing of each year's budget is an evil of no small magnitude, and a disturbing influence to the manufacturer and the shopkeeper, and consequently to the workman: common prudence, therefore, dictates that they should, without delay, organise themselves in a way that will make their voice heard for the speedy and final settlement of the question. A restricted trade may appear best for a small fraction of those engaged in it, and who may think that they have a snug corner to themselves which the competition of new men would injuriously disturb; but to those who live by their hand labour, it is of the first importance that there should be a large and growing demand for the things they work upon, and that will never come until the laws have been adjusted in the way that common sense along with ample experience dictates.

That this year may prove the beginning of a new era of prosperity for the silversmith is the earnest wish and hope of

AN OLD HAND.

Sheffield, Dec. 30th, 1881.

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Metallurgy of Nickel.

THE metallurgy of nickel and cobalt was illustrated in an interesting manner by Fleitmann & Witte, of Iserlohn., at the recent exhibition of the German patents and designs.

Dr. Kollman describes it as follows:—

It is only within a few years since the discovery of pure malleable and weldable nickel by Dr. Th. Fleitmann, that nickel has entered the rank of those metals which are technically employed on a large scale. Previously, only the alloys of nickel with copper and other metals could be easily wrought, while pure nickel could neither be hammered nor rolled. The reason of this was, that pure nickel absorbs (occludes) gases while melted (Fleitmann thinks it is carbonic oxide), and the nickel cannot be worked until these gases are removed.

Fleitmann's process for making nickel malleable, consists in adding a very small trace, only one-twentieth of a per cent. of magnesium, which is introduced in the form of a bar into the liquid nickel while in the crucible. This small percentage of metallic magnesium renders this brittle metal perfectly malleable, and it can even be welded. Magnesium is well known to oxidize very easily (at high temperature), and hence serves to remove these injurious gases. (Would not phosphorus accomplish the same end?)

The extraordinary technical importance of the new discovery (which is already patented in all countries) is evident at once. Formerly, alloys with comparatively a little nickel could be used, say, for coin. The German ten pfennig pieces (like the American five cent. piece) contain only twenty-five per cent. of nickel to seventy-five of copper. Now, on the other hand, we can have pure nickel cast in any desired shape, and also forge it and roll it like iron or steel. We may, indeed, assume with tolerable certainty, that if Fleitmann's method had been known ten years ago, we Germans would not have been pestered with our unhandy little twenty pfennig silver coins, for much more convenient ones could have been stamped from pure malleable nickel. Pure nickel, in addition to its malleability, possesses the great advantage, that it does not lose its lustre in moist air, and is unaffected by organic acids; while its alloys, we know too well, gradually lose their lustre and turn reddish.

Fleitmann, in his very interesting investigation, also made the discovery that pure nickel, treated with a very little magnesium, became weldable just like iron, and upon this he founded a method of welding nickel to iron. This discovery has gained very considerable importance, since we are now able to weld plates of nickel on both sides of the iron or steel, instead of merely depositing on it a thin coating by electricity.

The question of welding, which is not yet settled in the metallurgy of iron for Bessemer metal, for example, may perhaps be solved in a manner similar to that in which Fleitmann solved it for nickel. Its importance, technically and economically, hardly can be over-estimated. Nickel made by the new process, with magnesium, has a resemblance to carburetted malleable iron.

Kollmann made a series of tests of strength with Fleitmann's nickel, and arrived at a surprising result, namely, that the elasticity, as well as the absolute strength, correspond exactly with those of medium hard Bessemer steel.

The expansion by rolling and forging of the two metals is the same, so that they can be rolled together.

Kollmann then gives some of the numerical results of his tests, which we omit; but they go to show that the physical properties of nickel and iron are very analogous, so that the thought arises, that perhaps nickel is, after all, only an allotropic state of iron!

Since nickel and steel expand equally, blocks of nickel can be welded on both sides of an ingot of steel, and the whole rolled out into sheets of any desired thickness already covered with nickel. Iron wire, covered with nickel, could be drawn out just like ordinary wire. Another advantage is, that the welding as well as the melting temperature of steel and nickel is close together, so that the nickelized steel can be welded as before.

Cobalt can be rendered malleable and weldable in the same manner, *i.e.*, by the additition of a little magnesium.

Fleitmann has also discovered, that not only can nickel and cobalt be welded on steel and iron, so as to form nickel plated wire and sheets, but that it can be welded on to the alloys of copper and nickel, which can be rolled at a very high temperature. In this operation, the metals to be welded are surrounded with thin sheet iron, which is afterwards dissolved off, or is heated in an air-tight apparatus. In this way, too, sheet iron can be combined with alloys of copper and nickel by welding.

To prevent articles made of nickeled steel or iron from rusting on the cut surfaces, the iron beneath is dissolved away at the edges with dilute acids, and the projecting nickel then hammered down and welded over it. In Birmingham, H. Wiggin makes nickel malleable by adding two to five per cent. manganese.—*Scientific American.*

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We have to record the death, at the advanced age of 80 years, of the well-known chronometer maker, Mr. John Fletcher, late of Leadenhall Street, which occurred at his residence, 51, St. John's Park, Holloway, on the 19th ult. The deceased gentleman was a thorough practical workman, and for many years carried on a successful business in the City, from which, however, he withdrew some time previously to his death.

Some Practical Hints on Nickel Plating.

By R. Hartmann.

NICKEL plates and sheet nickel are now generally made by the manufacturers of nickel ware. These may be used in the production of a solution which is particularly well adapted for nickel plating. To this end the nickel is placed on a perforated board, in a saturated solution of ammonium chloride (sal ammoniac), and the metal brought in connection with the positive pole of a strong battery. By the influence of the electric current the metal gradually becomes dissolved, and a double salt is formed (nickel ammonium chloride) which settles on the bottom of the vessel, while, at the same time, the metal is kept continually in contact with the ammonium chloride.

If the nickel has previously been weighed, the amount of the metal which has become dissolved can at any time be determined by weighing the as yet uncombined nickel. In order to nickelize with this solution, a plate of pure nickel is suspended in the fluid, and it is connected with the positive pole of the battery, while the metallic body which is to be coated, and which must, of course, be well cleaned, is connected, after it has been immersed, with the negative pole. The nickel is precipitated from the solution as a bright coat, whose thickness depends upon the length of time during which the current is acting upon it, and also upon the strength of the latter.

In order to operate directly with the nickel sulphate, it is necessary to have a salt entirely acid free, which may readily be prepared by adding a small quantity of sodium hydrate (caustic soda) to the solution of the commercial salt, after having first removed the copper in the manner which will presently be described. When the acid is neutralized, an apple-green precipitate of nickel hydrate is formed, which is boiled for some time and then filtered. The solution is now perfectly neutral.

To remove the copper from the nickel salt, the latter is first dissolved in water, and acidulated by a few drops of sulphuric acid (commercial nickel sulphate is generally acid); then a current of hydrogen sulphide gas, which is prepared by pouring sulphuric acid over iron sulphide in a flask, is passed through the solution.

The copper and other metals which are likely to be present are thrown down in the form of a black precipitate. When the odour of the gas is distinctly recognised its passage is stopped, and the solution heated to expel the last traces of the hydrogen sulphide. It is then heated to boiling in a porcelain vessel with the addition of some metallic nickel. By this means the free acid is neutralized, and on evaporating to crystallization there remains a salt sufficiently pure for nickel plating.

The articles which are to be plated are suspended in the solution which we have just described, and they are connected with the positive pole. A nickel plate, which also dips into the liquid, is connected with the negative pole, and from time to time the liberated acid is neutralized by the addition of a slight quantity of ammonium hydrate. It is better still, for practical results, to spread a layer of nickel oxide over the bottom of the vessel in which the nickelizing is being carried on. This will dissolve in the free acid, and the solution will therefore remain neutral and of uniform strength.

The nickel oxide is prepared by completely saturating a solution of nickel sulphate with sodium hydrate (caustic soda), washing the precipitate, and then drying it. The nickel oxide thus formed is a heavy powder of an apple-green colour, and may be either spread over the bottom of the vessel, or else it can be placed in a linen bag and suspended in the liquid. If a solution of nickel sulphate, acidified with sulphuric acid, is poured into a saturated solution of ammonium sulphate, crystals will separate out, consisting of the double salt of nickel ammonium sulphate. The crystals are washed with cold water, dissolved in hot water, and then the solution is completely neutralized with ammonium hydrate. It is then allowed to stand for several days at a temperature of 20° to 25°, until no more crystals separate out. It is also of importance that the liquid be maintained at this temperature during the nickelizing, for otherwise the nickel will not adhere firmly to the metal.

During the operation of plating, a sheet of nickel connected with the positive pole of the battery is suspended in the solution. According as the nickel becomes separated from the solution the sheet dissolves, and thus the solution maintains its original strength. Plates of absolutely pure nickel are at present quite expensive, in consequence of the very high temperature which is required for their fusing and casting. By the addition of 1-5,000th part of phosphorus its point of fusion may be considerably lowered. As the phosphorus is not objectionable in nickelizing, the plates are generally made of metal containing phosphorus, and they are used to the best advantage in rather thin sheets; for, the larger the surface of the nickel plate the less will be the strength of the current required, and when the pieces to be plated are not large, as will occur in the majority of cases, two or three Bunsen elements will be sufficient.

In addition to the above methods for nickel plating, others have been proposed which also give good results, but which require more expensive preparations than those previously mentioned; thus, for instance, the double salt of nickel potassium cyanide and solutions of nickel nitrate have been proposed. On account of the vapours which escape from the cyanide solutions, although only in small quantities, they are particularly objectionable, and therefore the employment of cyanide preparations, on account of their poisonous properties, should be avoided whenever it is possible to do so. The nickel nitrate gives a beautiful and durable coat of nickel. The solution is most effective when it is composed of 4 parts of crystallized nickel nitrate dissolved in 150 parts of water, to which 4 parts of ammonium hydrate are added, and then 50 parts of the acid sulphite of sodium are dissolved in the above solution.

The acid sodium sulphite is prepared by heating sulphuric acid in a retort; the gas produced is passed through a small quantity of water, which will retain the copper which has been mechanically carried over, and then the gas (sulphuric acid) is dissolved in water until the liquid smells distinctly of burning sulphur. The solution which has thus been obtained is divided into two portions; one part is saturated with sodium carbonate as long as effervescence takes place, the other half of the acid is then added, and in this manner the bisulphite of sodium is produced. This must be employed as it is, because it is impossible to crystallize the salt by evaporation, for in so doing one-half of the acid would escape, and the mono-sulphite of sodium would remain behind.

For nickel plating of the finest kind, such as is produced in American factories, a solution is prepared from the nickel nitrate and acid sodium sulphite. It sometimes happens that the nickel will strip or peel off from the metals on which it has been deposited. It is said that this objection can be overcome by placing the dried plated objects into a bath of oil, and heating them up to 250°—270°.

According to Weston, a plating of great beauty and durability is obtained by mixing a solution composed of 5 parts nickel chloride and 2 parts boracic acid, with one made up of 2 parts nickel sulphate and 1 part boracic acid, and then adding, while continually stirring, sodium hydrate (caustic soda) until the precipitate is redissolved.—*Neueste Erfindungen und Erfahrungen.*

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(*Continued from page* 93.)

143. There is an arrangement which is entirely free from the above-mentioned objections (138), and applicable to openfaced and hunting cases, in which the push-piece projects from under the bezel, and is flat with the outside of the case. Its thickness of about one millim., or a trifle more, allows of its being pushed in with the nail without difficulty. The rim of the bezel in the open-face case, or that of the front cover of a hunting case, must be filed through, so that the end of the push-piece just fits into it. It is evident that there is no opening for the entrance of dust, that no pressure from outside can move the push-piece, and the former free position of the setting hands mechanism is instantly re-established by the action of the push-piece spring as soon as the setting has been done. The only inconvenience resulting from this arrangement is, that an open-faced watch of this kind requires the glass bezel to be opened for setting the hands, which is not necessary with the projecting push-piece. But with a well-regulated watch the setting hands is a rare occurrence, and even a little inconvenience in these cases is of no great consequence.

144. The other principal group of keyless mechanisms, those with the rocking platform, will also require some study. They offer some very important advantages, especially for fusee watches, where the fusee arbor, not being stationary, like the barrel arbor of a going barrel watch, requires an absolute independence of the rest of the keyless mechanisms at any time, except in the moment of winding. Therefore, the wheels on the rocking bar or platform in a fusee movement must be kept by a spring in a neutral position, touching neither fusee wheel nor motion wheel.

145. Most of these keyless mechanisms have three wheels on the rocking-bar, the middle one being the bevel wheel, into which the winding pinion gears. This latter requires no prolongation of its axis into the movement, and in many watches it depends only on the bearing of its arbor in the pendant of the case for its support. This, however, is objectionable, and the considerable amount of side pressure which always results from an angular transmission strongly indicates the necessity of giving the inner end of the pinion a support on the edge of the pillar plate, which is so easy to obtain. A pinion supported in this way allows also of inspecting the bevel gear without having the movement in the case—a convenience of some value. The rocking-bar is fastened in such a way that the centre of its oscillatory movement is the centre of the bevel wheel, so that the two wheels gearing into it at both sides remain in regular action with it in whatever position the bar may be. One of these wheels is continually in gear with the barrel wheel on the square of the barrel arbor, to which it communicates the winding action. The other wheel stands sufficiently apart from the teeth of the minute wheel of the motion work, so that it does not touch the teeth of it when the wheel at the other side of the bar is clear out of gear with the barrel wheel. Moreover, it is held at a sufficient distance from the minute wheel by a spring acting on the working bar (Fig. 36.)

146. Setting the hands requires the inverse position of the rocking-bar to be established by external pressure on a push-piece, to which the same observations apply as made on this subject before (138—143). The push-piece produces a change of position of the bar, bringing the other wheel on it into gear with the minute wheel, while a banking pin prevents the movement being extended further than required for a safe depth. After setting the hands, the bar is brought to its former position by its spring.

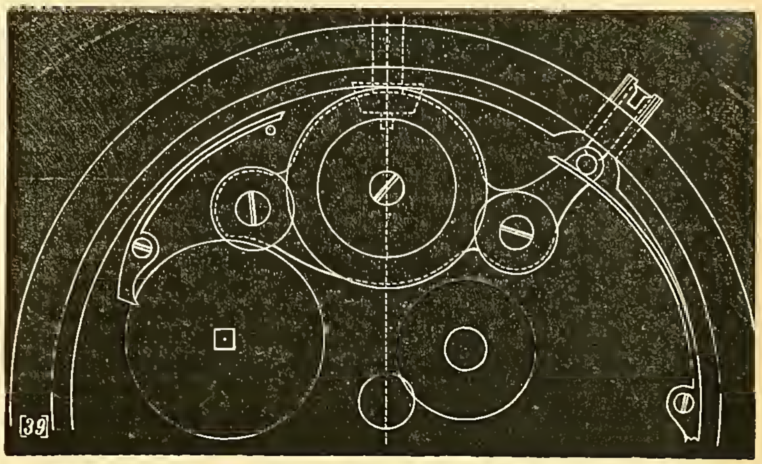

Fig. 42.

147. This arrangement has also the so-called Breguet click, and if it is attempted to wind the wrong way, the click-work prevents the barrel wheel from following the motion in this direction, and the rounded parts of the teeth of the rocking wheel slide over those of the barrel wheel, so that no harm can be done to any part of the mechanism.

148. In fusee movements, as already explained, this mechanism requires another arrangement, inasmuch as the wheels of the rocking-bar must be kept in a middle position between the winding and setting action, which is produced by a properly applied spring. For bringing the rocking-bar to act on the fusee wheel no push-piece is required. Here we see one of the surprising effects of friction, which is a constant and obstinate adversary of the watchmaker. The friction of the small intermediate wheel on its stud on the bar causes this latter to move round the centre of the bevel wheel by the reaction of the gear, as soon as the winding pinion is turned in the right direction. If this friction by itself is not sufficient to throw the wheel into gear with the fusee wheel with the necessary security, a small stiffening spring must be applied underneath the intermediate wheel, in a recess at the lower side of it. For setting hands, the usual push-piece must be resorted to. When turning the knob the wrong way, the fusee watch, having no Breguet action, the wheels on the rocking-bar only move freely, and without any effect whatever.

149. A beautifully devised keyless mechanism, with rocking platform, is that of Mr. V. Kullberg, one of the first-rate London makers. This mechanism has but two wheels, and the motion of the bar is derived from very subtle effects of frictional reaction of the gearing wheels. The only drawback to it is the necessity for a straight-toothed pinion and contrate wheel, since the bar does not oscillate round the centre of the contrate wheel. Mr. Kullberg describes his mechanism in the April issue of the *Horological Journal*, 1869.

(*To be Continued*).

Queries and Replies.

Amateur.—Would any of your numerous readers oblige by giving (through your valuable paper) the proper method of preparing the solution of the nitrate of binoxide of mercury, to be used previous to gilding?

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Lectures on Watch and Clock Making.

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

Delivered at St. Thomas Charterhouse School by I. HERRMANN on Monday Evenings, from October 25th.*

(Continued from p. 97).

IMPULSE RADIUS OF CYLINDER.

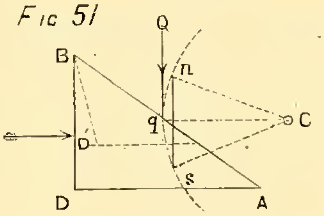
IT will be observed by Fig. 50 that really the impulse radius of the cylinder is not a constant quantity, because the point of contact moves from the outside surface to the inner on the engaging lip, and from the inner surface to the outer on the disengaging lip. Taken, however, in ratio to the radius of the cylinder, that variation takes place within very narrow limits; hence we may neglect it, and for practical purposes consider it a constant quantity. We are not far from the truth, therefore, if we take the impulse radius, equal to the radius of the surface of the cylinder, minus $\frac{1}{3}$ the thickness of the shell.

IMPULSE MOMENT.

Application of the principle of the wedge (Fig. 23, p. 130, Vol. VI.)

Let D A B, Fig. 51, represent a tooth of the escape-wheel, C the centre of the cylinder, and C q the impulse radius, and

Fig 51



let Q q be perpendicular to q C. Then Q q is the tangent to q C, and therefore represents the direction of the rotary motion of the cylinder at the point of contact q. Let n C s represent the lifting angle of the cylinder, then it is evident that the arc n s varies as the radius q C; but B D^1 must be equal to the chord n s, and we have shown that n s increases with the size of the cylinder, and D A diminishes; hence D B increases as B A diminishes, and therefore ∠ B A D varies in a double ratio. Let the direction of Q q be perpendicular to D A, which will give us the data for solutions, without altering the real condition; then, according to Fig. 33, p. 130, Vol. VI., P : Q : : D B : D A, or inversely D B : D A : : P : Q, where P represents the circumferential force of the wheel, and Q the impulse to the cylinder. From this we gather that Q diminishes as the radius q C increases; but the impulse moment is a sum of which Q and q C are the factors; therefore, it could be shown that if we neglect friction we should approximately get equal moments with different radii of cylinders. Taking friction into account, we obtain the exact conditions as shown on the pallet action, and therefore it is proved that it is desirable to have the cylinder as thin and the impulse radius as small as the limits we have stated will allow. We also know that D A : B A : : P : pressure; but apart from the friction of impulse contact due to pressure, we have also an increased pressure on the pivots, which increase in proportion to the ∠ B A D, and is at a minimum, when the direction of the rotary motion of the cylinder and the incline plane approximate to a right angle, or when ∠ B A D is least, and Q is greatest.

BY RESOLUTION OF FORCES.

(SAUNIER'S METHOD.)*

Let O and A (Fig. 52) be the centres of motion of the cylinder and escape-wheel, H K the direction of the incline of the tooth. Let M P represent the circumferential force

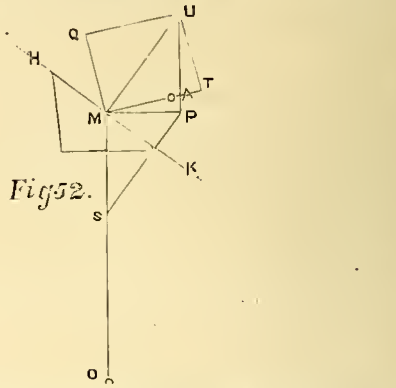


Fig 52.

of the wheel in magnitude and direction, M P being perpendicular to M O. Let M U represent the direction of the reaction, which is perpendicular to H K. Draw P U parallel to O M, and P S parallel to U M. Then M U is the resolved part of M P, acting in the direction at right angles to H K and M S, that part which is exerting pressure on the escape-wheel pivots. M U is again resolved in the direction of the centre of motion A, and in the direction of the rotary motion of the cylinder at point M, indicated by M Q at right angles to M A. Draw U Q parallel to A M, and complete the parallelogram Q U M T; then M T represents the pressure on the pivot A, and M Q the force with which the cylinder is turned about its centre.

CONDITIONS OF REST.

In the dead-beat escapement the resistance is proportional to the normal pressure of the tooth; but in the horizontal escapement we have a condition which is synonymous with pressure on the duplex roller and guard pin on the surface of the lever roller, as we shall see.

Let A B (Fig. 53) represent the semi-circumference of the shell of the cylinder, C the centre of the cylinder, and W the centre of the wheel; let p be the point of contact of the tooth with A B, and let p q represent the circumferential force of the

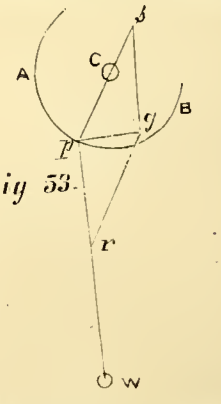


Fig 53.

wheel in magnitude and direction; then the direction of the reaction of the pressure on A B will pass through C. Draw q s and complete the parallelogram q s r p, then p s will represent the pressure on the cylinder circumference, and p r on the escape-wheel pivots. It will be readily seen that when ∠ s p q becomes o, p s becomes equal to p q: that is, the pressure is equal to the circumferential force only, and as s p q approximates to a right angle, the pressure becomes indefinitely great: therefore, the resistance to the cylinder by pressure is at a minimum, when the wheel radius of contact forms a tangent to the cylinder radius of contact.

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* Modern Horology, page 118.

In every respect, then, there are the exact parallels with regard to impulse angle, radius of impulse, and resistance during the supplementary arc, and hence we can apply here what we have learnt about the dead beat. Saunier gives the impulse angle for large watches at 40°, medium sized at 30°, and small at 60°. That a light balance requires a larger impulse angle or height of incline of the tooth can easily be practically tested. Some old horizontal watches have sometimes a very low incline, and therefore a small impulse angle, with a very light balance, and, as a rule, a bad vibration. If the escape-wheel is replaced by one with a higher incline of teeth, the action is always considerably improved.

The impulse angle must not be identified with the angle of impulse contact: the former is always constant, but the latter varies in proportion to the depth or the line of centres. When the heel becomes disengaged from either lip, the angular measures of the position of the tooth, or the arc of the shell in relation to the corresponding lip, will be proportionate to the depth, and this angle, added to the impulse angle, will give the balance angle of impulse contact. This angle is indicated by the three dots on the plates of Geneva watches.

Remarks.—It is not advisable to pass an escapement of such an angle that it sets. Hence, though the points where the drop occurs correspond with the dots on the plate, yet if it sets, I should always make the escapement shallow, to reduce the angle on either side of the central dot; because, notwithstanding what has been shown as to other conditions, the prevention of any possible setting in wear stands primary.

The treatment of the conditions of the curved inclines given to escapement teeth would lead us too much away from the main object. Saunier discusses the various points, and concludes from experiment that a curve drawn with the radius of the wheel will give the best result. The question of timing in the horizontal escapement brings us face to face with problems; the points for whose solution we can only indicate, but leave the work until another period.

It is, again, the harmony of the ratios of size of cylinder to balance and escape-wheel, impulse angle, angle of rest, number of vibrations, &c. That this is a real practical question any watchmaker can test. Let him take a drum timepiece with a horizontal escapement, and attempt to time it for equal periods for the first and last turn of the main-spring, and try to solve it. He will find the solution in Saunier, which we may also attempt at a future period, and in an advanced course.

METHOD OF CONSTRUCTION.

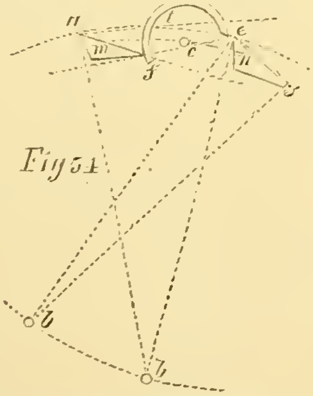

Fig 54

The horizontal escapement is the most complicated to draw or set out, because we have no data of real service. The following proportions are the result of calculation, and can be verified by the drawing, the ratio of which they furnish.

Let $a\,b$ (Fig. 54) be the radius of the periphery of an escape-wheel, say = 10 inches, and $a\,b\,c$ the angle contained between the heels of two adjacent teeth. Bisect the arc $a\,c$ in r, and make $\angle\, r\,a\,f$ = 23° 30° and $r\,c\,f$ 18° 30°, and make $a\ f$ 1·978, and the diameter of the cylinder = 2.413. Draw the arc $m\,n$ through the middle of the incline $a\,f$, this arc will give the position of the centre of the cylinder. The proportions of the cylinder have already been given (96-97); $c\ s$ shows a curve drawn with radius $a\,b$ from centre b'. The rest of the details belong to the drawing class, with the work of which we are not now engaged.

THE DUPLEX ESCAPEMENT.

This escapement is now comparatively seldom made, and not often met with. The great skill that is required in making it, and the great care that its delicacy demands, have made it unpopular both to the trade and to the public. This delicacy is the result of the mode in which the resistance to the moderator, during the rest of the escape-wheel, or supplementary arc of the balance, has been minimised. This can be seen, perhaps, relatively. We have shown that, if in a dead-beat clock escapement the moderator is reduced below a certain size in length and mass, the clock will stop, and especially so with great motive power, by reason of resistance, which is the product of the pressure on the resting surface, multiplied by its distance from the centre of motion. We have also seen that in the horizontal escapement this resistance is proportional to the size of the cylinder, and virtually, according to the ratio of inertia of the balance, cylinder radius, and circumferential force of the escape-wheel, and angle of the radii of resting contacts.

Though the former conditions of resistance have been reduced, by having in the ruby roller the smallest radius of friction or pressure during the auxillary arc, yet the angular position of the point of contact during rest greatly neutralizes the otherwise useful effect.

When the end of a lever arm rests against a rotating cylinder or disc, the resistance to the latter is least when its radius to the point where they touch makes a right angle with the lever arm, and is most intense when they form nearly a straight line. Now, in the dead-beat clock escapement we have the first conditions, in the cylinder escapement the intermediate, and the duplex approximates the last-named.

Thus, in the duplex escapement, we have the roller mounted on a very small axis, and though we reduce the resistance to rotary motion, the pressure on the roller surface and on the pivots is not reduced, assuming that the circumferential force of the escape-wheel remains constant, and thus the factor in its best property is the factor of its unserviceableness in practical application.

Let Fig. 55 represent this condition. A B is the ruby roller, C the centre of the balance, and W that of the wheel. Let $\angle\, a$ C W = ½ the angle of rest = 17° 30′, and $\angle\, a$ W C = ½ the wheel angle of rest = 1° 30′.

Let $a\,b$ represent the circumferencial force of the escape-wheel in magnitude and direction.

Draw $b\,o$ parallel to W a, and produce a C, meeting $b\,o$ in o, and complete the parallelogram $a\,o\,b\,r$, then $a\,o$ represents the resolved part of $a\,b$, which is exerting pressure on the roller and on the pivots. From this we see that whereas in a clock dead-beat $a\,b$ would represent the pressure; here we have the effect more than double, and hence the cause of its delicacy.

This part of Fig. 55 is in principle the same as shown in Fig. 53, but we have reproduced it for the purpose of illustrating the above fact, as we find it in the duplex roller contact.

Likewise, it is evident, that when the contact is tangential, it does not matter in which direction the disc or roller would be moving; but this is not the case when the radii of contact assume or approximate to the angular position shown in Fig. 55. Thus, when they both move, or tend to move, in the direction indicated by the arrows 1 and 2, $a\,o$ represents the pressure on point a—this is termed engaging contact; but when they move in contrary directions, as indicated by arrows 1 and 3, we have a different condition.

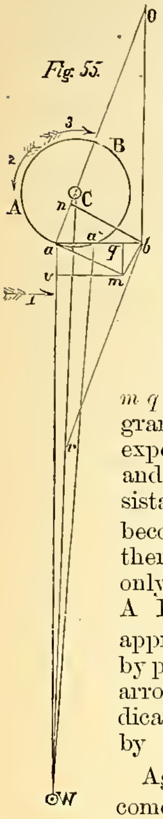
Fig. 55.

Let $a\,m$ (Fig. 55) represent the rotary energy of the roller in magnitude and duration. Draw $b\,m$ parallel to a C, and complete the parallelogram $a\,n\,b\,m$, then $b\,n$ represents the resolved of $a\,b$ offering resistance to the rotation of A B, and $a\,n$ the resolved part of $a\,b$, exerting pressure on a. Again, draw $m\,q$ parallel to W a, and complete the parallelogram $m\,q\,a\,v$, then $q\,m$ is the resolved part of $a\,m$ expended in overcoming the resistance by pressure, and $m\,v$ the resolved part $a\,m$ in overcoming the resistance of $a\,c$. It is evident that when $\angle$ C $a\,b$ becomes = o, $a\,n$ becomes = $a\,b$, and $b\,n$ vanishes; therefore we have $a\,b$ exerting normal pressure only, hence offers equal resistance to the motion of A B in other directions; but when $\angle$ C $a\,b$ approximates to 90°, $a\,o$ represents the resistance by pressure when the roller is moving according to arrow 2, and when moving in the direction indicated by arrow 3, $a\,n$ represents the resistance by pressure.

Again, when $\angle\ m\ a\ b$ becomes $\doteq$ 90°, $a\,v$ becomes = $a\,m$, and therefore the whole rotary energy of A B is expended in overcoming resistance by normal pressure, of $a\,b$, because $v\,m$ vanishes, and $m\,a$ makes a right angle with $a\,b$.

That these conditions very nearly represent the truth can be practically tested.

In a horizontal watch, or in a duplex with a very light balance and slow train, it will be observed, that when the balance moves according to arrow 3 it vibrates freely, when on its return motion in the direction of arrow 2 it is retarded, and if the motive power is great, very likely will stop. Again, in a lever watch, though it may mislock, the balance is not stopped when moving in the first direction, but immediately when in the direction of the latter. Thus it is evident that there is a great difference of resistance in the two directions of balance motion during the supplementary arc, or the engaging contact represented by arrow 2, and disengaging contact according to arrow 3. In the first the moment of resistance = $a\,o$ × co-efficient of friction × a C, and in the second = $a\,n$ × co-efficient of friction × a C × $\frac{b\,n}{a\,b}$

(To be continued.)

◆

Mr. Sagner uses for the hardening of steel for tools an apparatus of his invention, which he calls "régénérateur carburateur," in which the steel or rod iron pieces introduced take carbon to a certain depth only, according to requirement. Tools prepared in this manner acquire a great hardness on the outside, and on the working parts, whilst the inside, containing less carbon, secures the strength of the tool.

The Story of a Presentation Watch,

AS TOLD AT THE JAW-MUNDUM CLUB.

By C. Stuart Murray.

NIGHT THE "FINIS."

"The end crowns all."

"What a noise, 'ping, ping, ping,' the pallet-beat makes."

"You are right; and when you have a bit of a headache, you feel as if your head was a steel target, and that the 'pings' were so many rifled cannon-shot pinging against it."

"The blows on the faces of the pallets," I said, "must be trying all day long."

"I am only with her for six hours at a time; and that is quite long enough. Do you notice the roller?"

"It is a fine plate of steel. Where did you get it from?"

"It was made somewhere in Sheffield. It is a plate of the finest cast steel, and afterwards annealed. It is planished true, and cost a hatful of money."

"I see that it is a going-barrel movement."

"Yes, that barrel is made out of a slice of an old gasometer that happened to be here when we came. The spring was made in sections inside of it."

"You must have had rare trouble in fixing it in its barrel end on."

"Oh, no. It is on the Phillipps plan. There is only the barrel-arbour end hooked; the other acts by its pressure against the side of the barrel. But these are not the permanent barrel and spring. New ones are up at the Royal Observatory ready to be built when the watch goes there. We will now walk upstairs, if you please, and look at the dial."

"Another word, first. What is the barrel-arbour made of?"

"It is made of Whitworth's compressed steel. It was intended for the screw-shaft of a man-of-war now being built at Chatham, but was thought to be rather too slim, so our people got it and made it what you see. There was some little trouble to fit the hook on for the mainspring eye."

"How do you wind it up?"

"That is done by a dynamo-electric machine every morning, through the automatic action of the watch itself. There is a twenty-four hour snail with a spring pinned into it, and this pin closes the circuit every morning at nine o'clock, and so winds up the watch. Now, for upstairs."

Upstairs we went, and sure enough there was the dial; and with the dial I saw the winding button and the setting stud, with which, as old Pepys would say, I was mightily pleased. The centre-seconds hand was not a dead beat, but a "trotter," beating fifths. I was told that a dead beat would have shaken the movement too much, on account of the long space from one second to another, which upon a twenty-foot dial was something. Each jump would have been nearly a foot, and that was considered too much and too violent.

"How do you set the hands?" I asked.

"In the usual way. I have a two-foot lever-wrench—a spanner, in fact—and my mate puts the setting-wheels in gear by means of their stud, when I turn the spanner to what I want. But she goes so well that we seldom have occasion to use it. We will now walk downstairs and have a look round on the bottom plate at one thing and another. You will see the fit proportion of the balance and screws better presently when we get under the plate than we can do here, as you can readily understand."

"Hush! Lay hold of that pillar and swing yourself gently off the plate, for I see the Astronomer-Royal, Sir Edmund Becket, the Horological Institute, and the Editor of the *Watchmaker* coming to look at her."

I let myself down, as I thought, gently; but the pillar-plate being so much higher from the ground than I expected, I dropped with a thud like missing the bottom step in a ladder. That awoke me. *And that was my dream.*

"And a very good dream, too, and very well told," was chorused around.

Well, I think, having finished the dream, and having been so liberally rewarded by your generous applause, I will now proceed to the finish. I wound up the watch before going to bed, to make sure, as I said, of its not running short of power during the night. I laid it on its back as usual, and retired to rest. Surely enough, I fell asleep almost immediately, and slept as soundly as a spinning-top when at the motionless point of its speed, until I was called in the morning. I arose about half-past seven, and at once looked at my "chrono'." I was partly prepared to find it at a standstill. I took it up as gently as I could, when, as before, off it started again. As it was a holiday with me, I was soon with my watchmaking friend, as before. This time the discovery was that the balance screws, or some of them, touched the edge of the upper plate. He took it off, and just found room enough to grind a clearance without touching the setting of one of the jewel-holes. "That," he exclaimed, with some pride, "will about answer your purpose:" and away I sallied.

Two or three weeks had passed, when one morning, at Folkestone, I went down to the pier telegraph office to compare the time, as I had something to do, and wanted to run the minutes as closely as possible for the London train.

"That is a fine watch, sir," said the telegraph clerk, as he looked at it.

"Why, yes," I replied; "it ought to be, as it has cost a fine lot of money."

"It is not going, sir," he remarked.

I hurriedly cast my eyes upon it, whilst I felt the blood sensibly rushing into my head. "Ah! God bless me! I must have forgotten to wind it up." Then hastily performing that operation, I set it to time by the office clock —I wonder that I did not break the chain in winding—and hurried out upon my business. There I was in the town with a ticker that would not go. (Laughter.) I called upon a watchmaker whom I knew, and told him my latest mishap. He looked into it, shook his head, and said that he "could make nothing of it without taking it to pieces." I thought as much, and on returning home determined to try a new shop; the fact was, I was really ashamed to go any more to my former "examiner." To a new shop I accordingly went, and left it there. Mind you, I was known to the new man through belonging to the same Foresters' lodge. In about a week's time I had the pleasure of paying a bill, on which were the words: "Dial-foot through brass edge and foul of third wheel." "The balance out of round." "Bound main-spring, also defective hooking." "Burr on pendulum-spring collet." "Guard-pin catching against the burr of the scoop-out edge of roller." "All defects now made good."

I had long thought that it was nearly time for all defects to be "made good," but I had not done yet. Four months had passed away without any trouble beyond an occasional "jib," which I was determined not to mind, as I had passed sentence for the sale-room, when Mr. Webb came to town, and commenced inquiries to ascertain how such a man as a joint-finisher was employed to make a presentation, or indeed, any watch. The first result of his inquiry was, that the "maker," having heard how *his* handiwork was doing, and knowing that he would be called to a very unpleasant account, had emigrated across the seas! Mr. Webb and the "recommender" then came to an agreement that, if the cases could be made to answer, another movement was to be put in by a really "first-class man" this time. Another member of the Presentation Committee was related to one of the great City firms, to whom he would mention the matter, and take his advice. This was the firm that would have made the watch, had not the "first-class" joint-finisher been so strongly pressed upon the committee. This was done, and a note was given to a watch examiner and finisher of repute who made for the firm, and I was to take the note and leave the watch. This I did, and at the end of six weeks the new maker called upon me with the watch, which he placed on the table "better as new," and a small round box which he rattled.

"There is your watch, sir," he exclaimed with glee, "and I do not think that you will have any more 'stoppings' in the way that you have told me. I have one little favour to ask; and that is, that you will take it to my City people and let them see it as soon as you can spare the time."

"What have you got in the box?" I asked. "That, sir, is the 'rotten work' that I have taken out of your watch. And how any man calling himself a watch examiner could pass that abominable muck, and make you pay for attempting to make that go, which by no possibility could be done, I cannot understand. What a pity you did not go to our City people at first."

"Ah," I said in sadness, "if the committee had gone to your people *at first*, the infernal torture and expense that I have gone through would never have arisen. But turn out the contents of the box." This he did directly.

"What a lot," I called out.

"What a lot, indeed," he echoed, as he began to take them up and explain what they were. I told him that he might save himself the trouble, for I did not understand his information.

"Just say what you have done."

He handed me a paper, and among many things I read that he had put a new escapement in "out-and-out"—lever, pallets, 'scape-wheel, and all. Then there were a new barrel and new barrel spring, a new fusee and chain, several new wheels and pinions, new work for the centre-seconds, and new jewelling.

"Then how much of the original watch is left?" I asked.

"The pillars and the plates," he replied grimly, although *they* have passed through the mill, and the centre-wheel. Here is all the old work in the box. Of the case the bezzle is all that is new. The centre of the dial is new, and the hands are new. You will find nothing to complain of in future."

We chatted some little time, and when I told him that I had spent nearly ten pounds upon it, he gasped with astonishment.

"But how," I asked, "about the big maker in the country?"

"I know him very well," he answered, "and I can assure you, sir, that if he knew of any man turning the work out like that—or rather not turning it out at all—he would sack him on the instant; even if he was the best hand in the shop. What he wrote to you about being done, he believed to have been honestly done. If you had sent that watch back when it stopped, he would have examined it himself, screw by screw; and woe betide the man who had deceived him." And with that my new examiner took his leave.

Well, gentlemen, it is nearly time to wind up. Here is the "ticker." It has been going now for eighteen months, with a variation of only a few seconds a week—*and no stopping.* So pleased am I with it, that I keep the card of the regenerator on my private room mantle-piece.

"To look at," said some-one laughing. Yes, to look at, and to remind me that if I want anything done well, by far the best way is to find out the man who knows how to do it well, and who practises that style of work. I reported to the committee what had been done, and how it had answered. I need hardly say that they were quite as highly delighted as I was, and that they became that watch examiner's friends. You may depend upon it that I did not hide his light under a bushel. Whenever I hear of anyone wanting such a workman, I tell them where to go, and what they will be sure to find. Although I had paid whatever was charged to me, there can be little doubt but that I got the "nasty" without the "cheap." And that, gentlemen, is how I became the victim of a testimonial. I am glad that I have finished, because I go away to-morrow to my native place on a long holiday, and I do not know when I shall be likely to have the pleasure of being with you again. I thank you most sincerely for the kind way in which you have listened to me, and—and gentlemen, *I have done.*

Our friend closed his narrative with a considerable amount of emotional feeling that went to the hearts of all of us, shook hands all round, and took his departure. We never saw him afterwards; but his tale made such an impression upon me, from time to time, that I carefully took notes of it each night when I reached home. To him, therefore, good reader, and to those notes—which are not fiction—you are indebted for the varied, strange, and somewhat humourous

"Story of a Presentation Watch."

Gems and Jewels—in Relation to their Biblical History.

By J. W. Singer.

(*Continued from page 92.*)

No. 12.—The *Onyx*—Hebrew "Shoham." The Rabbins translate this "emerald," and the Romans gave the name of onyx to two stones; one a kind of marble, like our alabaster, and another a silicious gem. The ordinary onyx is distinguished from the sardonyx when the red, brown, or yellow ground has a layer of white disposed over it; and that is now called "sardonyx," which has the red layer uppermost, both being the same stone. The name onyx is derived from a Greek word, meaning "nail," it being supposed to resemble the *human nail*, as to the layers, a thin layer over a thick one. The stone had a bad omen formerly, as it was said to cause strife and melancholy, but yet cured epileptic fits. Mithridates, the King of Pontus, had 2,000 cups of this stone.

No. 13.—*Jasper*—"Jashpeh" in Hebrew, and "Jaspis" in Greek. Tradition says that this was the stone upon which the name of Benjamin was engraved. It is the *last* mentioned in the Breast-plate, but the *first* used of the twelve stones mentioned in the foundation of the New Jerusalem; and in Rev. xxi. 11, it is said, speaking of the Holy Jerusalem, "And her light was like unto a stone most precious, even like a jasper stone, clear as crystal." The emerald pillars spoken of by Roman and Greek authors were probably green jasper, and what is called "blood-stone" (from having red spots in it) is a variety of jasper. Galen said of this stone, that if a jasper be hung about the neck it will strengthen the stomach. From the similarity of the name in many languages, the same stone is no doubt intended to be mentioned.

It being impossible in so short a lecture to make mention of a tenth of the stones called precious, I will speak more fully of that one most known, and most spoken of, and that is the diamond. As before mentioned, it is a very moot point whether the ancients knew of it anterior to the Roman Empire. Of course, it has been translated as if they did know it, but the word used would apply to any of the hard corundum stones. It is said that the Etruscans, by their commerce with the East, knew of it, and used it ornamentally. The Greeks also knew something of it, and attributed great magical virtues to it; and it is certain that the Romans knew of it, as several rings are known of the Imperial era, having natural diamonds in them; but they knew nothing of polishing it. The ancients gave the name of *adamas*, that is, "invincible," Latinized into "adamans," because they believed it capable of resisting every chemical agent, without itself experiencing the least alteration. The first indisputable mention of the diamond is met with in Manilius, who flourished in the Augustus age, ix. 926, "Sic Adamus punctum lapidis, pretiosior auro," and the Romans only valued the gem on account of its supernatural virtues, as they saw none of the beauty that we now see in it. Thus Pliny says that it baffles poison, keeps off insanity, and vain fears; and was thought of for its hardness, and not for its beauty. "Lapis parvus atque indecorus." The diamond is simply pure carbon, crystallized—the Great Creator having, as it were, made the most precious things from the commonest material. Thus the diamond and coal are almost the same thing, the one being the same as the other as to combination, but crystallized. The sapphire and the ruby are only crystallized clay; the topaz and the amethyst crystallized flint, with colouring matter, generally from iron. But although the diamond is so much thought of, its importance is far less to us than its humbler brother, coal: the pure carbon, or diamond trade, amounts to only about a million a year, whereas the impure carbon, or coal, brings in about twenty millions a year to England alone. We are accustomed to associate carbon with blackness, because all charcoal is carbon, though all carbon is not charcoal. The blackness is merely caused by heat, and *white wood* and a *lady's skin* are mostly composed of carbon, and both are blackened when burnt—it being the crystallization which produces the transparency. Many compounds of carbon are transparent; carbonic acid gas in the upper part of a soda-water bottle, which is a compound of carbon and oxygen, is invisibly transparent. The same gas, with lime, when crystallized, forms *Iceland spar*, and is *clear*; but the same, when uncrystallized, is *chalk* or *limestone*, and then *opaque*. The crystal of carbon, when perfect, is of a octahedron form, that is, an eight-sided double cone. Thus, whenever any stone is found of this form, you have the most certain test that it is a precious stone, it requiring great knowledge to tell them when found in other shapes, which are called "amorphous," from two Greek words, meaning "without form." It was long after the mode of polishing the diamond had been found out, that the art of cutting it was discovered, this latter being done by means of a fine wire covered with diamond dust. The process is so tedious that it takes eight or nine months to shape a large diamond; and altogether some of the largest stones known took two years to finish them. The Koh-i-noor took nearly a year; a steam-engine was set up purposely, and two men were brought over from Holland, so that it might be done in London. For polishing and facetting a diamond, the stone is embedded in soft solder (as it takes great heat to injure a diamond), leaving out just as much of the surface as you wish to cut. The solder is attached to an arm, which rests on an iron disc, which revolves about thirty times in a second, and may be two feet in diameter, the surface of the plate being covered with diamond dust and the finest olive oil. The plate revolves continuously, the workman taking up the arm occasionally to see if the stone is enough cut and polished. When the stone is so far done, it is taken out of the solder, and rebedded again, presenting another surface to have a facet, this being entirely done by the eye. Formerly this was done by a foot lathe, but steam power is now used. The trade, until the last ten years, was mostly confined to Holland, and there entirely carried on by Jews, about ten thousand being so employed. The diamond called a *Rose*, and that called a *Brilliant*, are both precisely the same stone, but differently cut. The rose can be cut from a smaller stone, hence of less value, is flat at the back, and pointed at the front, having twenty-facets. This, with the table diamond, were the only patterns known until the first quarter of the eighteenth century. Even the jewels ordered by Queen Anne for the Duke of Marlborough were all rose diamonds. The brilliant shape was invented as late as the reign of George II., and has the shape of two cones, united by their bases. For a good brilliant there would be thirty-two facets above the girdle, or part where set, and twenty-four below the girdle, and the facets are named after their several forms, dentelles, lozanges, feuillets. Small stones lose from 38 to 40 per cent. in size, and large ones 50 per cent. or more. About the time of George I., the chief seat of the diamond cutting business for the whole world was in London, and even now an old town-cut brilliant can be told from a Dutch one, and commands a far higher price, because these latter sacrifice exact form, to preserve the weight. The process is now much quicker than formerly, as it once took a whole week to finish one facet, and the stones were only bedded once in that time. It is only in our own times that diamonds have been set *transparently*, it having been formerly thought that the best way to show the genuineness of the stones was to back them with a varnish of ivory black, as it made anything but a diamond look dull and lustreless if set in a black composition. The only test for telling whether a stone is a diamond or not, is its *hardness*, as nothing will cut it, and it cuts every other thing when properly applied; the crystallised form being not quite certain, as the spinel has the same form.

(*To be Continued.*)

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 84.)

ANDREA CIONE DI MICHELE, called Verrocchio, the pupil of Donatello, born in Florence in 1435, was goldsmith, painter, and sculptor in marble and in metal, and second only as a bronzist to his great master. Of his admirable works as a goldsmith nothing remains to us, and the two *relievo* subjects in silver, which adorn the altar-front made for the Florentine baptistery, alone exist of his sculptures in that metal. He cast a bronze ball to surmount the cupola of the Cathedral. His works, by no means numerous, are marked by great individuality and highly-finished execution, not free from a certain rigidity and hardness of outline, which we lose, however, in the equestrian statue of Coleoni. A work of smaller size, but characteristic of his manner, is the youthful figure at South Kensington (No. 411—'54). In the Bargello, at Florence, is "The David," a somewhat angular figure, but of considerable nervous vigour; it was executed in 1496. A graceful statuette is on the fountain in the courtyard of the Palazzo Vecchio, a work, probably, of his later time—a child pressing a dolphin, which spouts water. The admirable modelling and manipulative skill displayed upon the festoons and cordage of bronze, enriching the monument executed by him to the memory of Piero and Giovanni de Medici, in San Lorenzo, at Florence, show what care he bestowed on details. But his greatest work was that portion of the model for the statue of Bartolomeo Coleoni, the Venetian general, which he was enabled to execute before his death; this part, from the wording of his will, would seem to have been confined to the horse, the second and finest equestrian statue of large size which had been produced since the decline of classic art.

Having modelled the horse, Verrocchio returned disgusted to Florence, after breaking its legs and head, on learning that the signory intended Vellano, of Padua, to execute the figure. He was, however, induced to resume the work at Venice, and had not completed his new model for the charger when he was carried off by a violent illness, in 1488. He desired that his friend Lorenzo di Credi might finish the work; but it was entrusted to Alessandro Leopardi, by whom we may presume that the figure was remodelled, partly, perhaps, after Verrocchio's sketches modified by Leopardi. The casting and finishing were executed by the latter artist, to whom, indeed, at least an equal share of praise is due, and who was probably justified in inscribing on the saddle-girth "A. Leopardi, F." Also of Verrocchio's later period, although commenced some twenty years before (1484), is the group of bronze statues representing Christ and the incredulous St. Thomas, which occupies one of the niches outside the church of Or San Michele in Florence. It is a work of great expressive power and careful execution, but dry and hard in the lines, angular and heavy in the draperies.

Giovanni Francesco Rustici (1470—1550), a pupil of Verrocchio, who afterwards worked with and under the instruction of Leonardo da Vinci, was an amateur but assiduous artist, who executed some works in bronze. Among these was a Mercury for the Medici Palace, a *relievo* representing the Annunciation, for Spain; and his chief work, the group over the northern door of the Florentine baptistery, representing St. John disputing with a Levite and a Pharisee, in the modelling of which he is said to have been greatly assisted by Leonardo. Disappointed with the mean payment he received for this able work, Rustici, after wasting time and money in frivolous pursuits, went to France to undertake a statue of Francis I., which was never executed, and there he died in poverty.

Another abundant sculptor in bronze of this period (1433—1498), who also was a goldsmith, a niellist, and a painter, but whose somewhat exaggerated manner in figure subjects and fluttering drapery is frequently objectionable, was Antonio Pollaiuolo, who had learned his art under Bartoluccio, and in the studio of Lorenzo Ghiberti. To his hand chiefly is ascribed the beautiful frieze that surrounds Andrea Pisano's Gate, in which a quail is particularly pointed out as his work, and admirably true to nature. By him also were executed some of the *relievo* subjects representing the dance of Herodius' daughter and the feast of Herod, on the silver altar frontal for the Florentine baptistery. In bronze, among his most important and finest works, are the tombs of Sixtus IV. and Innocent VIII. at Rome, in which he shows his great skill as a modeller and caster, and a high degree of artistic power. These qualities are particularly seen in the magnificent tomb of Sixtus, date 1493, one of the grandest bronze monumental works of the *renaissance*, and which is so conspicuous in the chapel of the Sacrament at St. Peter's. The fine but realistic recumbent figure of the Pope is placed upon a cushioned base, the sides of which are panelled with allegorical figures of the virtues in exaggerated style, and enriched with foliage, mouldings, tassels, &c., of the most admirable execution. The mural monument to Innocent VIII. is a later and smaller work; it is placed on one of the piers of the cathedral, and represents the Pope seated above, and recumbent as in death below, with surrounding figures of the virtues, &c. In St. Peter's, also, are the bronze candelabra that formerly stood at the sides or head of the tomb of Sixtus. The bronze doors which enclose St. Peter's chains in the sacristy of that saint's church "in vincoli" at Rome are another work by this master. They are covered with interlacing and foliated ornamentation in *relievo* of great beauty, surrounding two panels that respectively represent the imprisonment and the liberation of St. Peter in bas-relief.

(*To be Continued.*)

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

(Specially Translated and Revised for this Journal.

(*Continued from page 95.*)

No. XXXII.

Throw the liquid upon a filter of calico stretched on a wooden frame, the cyanide of silver remains on the cloth, the solution with the nitric acid and excess of prussic acid passes through. Wash the precipitate left upon the filter two or three times with pure water.

This cyanide of silver is put into the vessel intended for the bath, and stirred with the $2\frac{1}{3}$ gallons of water. The cyanide of potassium is then added, dissolves it, and also dissolves the cyanide of silver; thus giving a solution of a double cyanide of potassium and silver. Those who employ small baths, often renovated, may substitute for the cyanide of silver the chloride, or the nitrate, of this metal. In the latter case, the quantity of cyanide of potassium should be increased. Such baths will be prepared as follows:—

1. The nitrate of silver is prepared in the manner indicated above, and $5\frac{1}{4}$ oz. of it, nearly equal to $3\frac{1}{2}$ oz. of pure silver, are dissolved in $2\frac{1}{3}$ gallons of water. 2. The cyanide of potassium No. 1, about $8\frac{3}{4}$ oz., is then added. Stir to facilitate the solution, filter the liquor to separate the iron contained in the cyanide. This operation may in some cases be dispensed with, because the iron rapidly falls to the bottom of the bath, and the solution becomes limpid. The proportion of cyanide of potassium employed is more that is required for dissolving the silver, as $1\frac{1}{2}$ part of good cyanide is sufficient for 1 part of silver; but unless there is an excss of cyanide of potassium the liquors do not conduct electricity well, and the deposit of silver is granulated and irregular. The silvering is effected with a battery, and with baths either warm or cold. The latter method is generally adopted for articles which require great solidity. The hot process is used for small articles, and is preferable for steel, iron, zinc, lead, and tin, which have been previously electro-coppered.

The hot baths are generally kept in enamelled cast-iron kettles, and the articles are either suspended or moved constantly about in them. The preliminary cleansing in acids, and passing through the mercurial solution, are necessary. A somewhat energetic current is needed, especially when the articles are moved about in order to operate rapidly. There is too much electricity when the articles connected with the negative pole of the battery become grey or black, and produce many bubbles of gas. A platinum, large wire or thin foil anode, is generally preferred to the soluble anode of silver employed in cold baths, but the solution is rapidly impoverished. In hot silvering baths, the separate battery is often replaced by a zinc wire wrapped around the articles. The points of contact of the two metals are black or grey; but the stain disappears by plunging the object into the liquor for a few moments, after it has been separated from the zinc and carefully scratch-brushed.

Instead of separate batteries, a simple apparatus may be made of a glass, porcelain, or stoneware vessel holding the bath, and in the centre of which is a porous jar filled with a solution of 10 per cent. of cyanide of potassium or common salt. The cylinder of zinc, immersed in this porous jar, carries a larger circle of brass wire, the cross diameters of which are soldered to the zinc. This brass ring projects over the bath, and the articles, suspended to the ring by slinging wires, hang down into the bath. At the beginning the operation goes on rapidly, and the deposit is good; but after a time, the solution of zinc traverses the porous cell and impairs the purity of the bath. An impoverished hot bath is reinvigorated by addition of equal parts of cyanide of potassium and silver salt. It is necessary to replace the water in proportion as it is evaporated. When the silver baths rapidly deposit metal without the aid of electricity, it is a proof that they are too rich in cyanide, or too poor in silver. A deposit affected under such conditions is rarely adhering, especially when upon articles previously coppered; because the excess of cyanide dissolves the deposited copper, and the silver which takes its place may be removed with the finger.

The remedy consists in adding to the bath only enough silver salt and no more, so that a piece of copper will not become sensibly silvered in it without the aid of electricity. The cold electro-silvering baths generally employed for electroplating such articles as table-spoons or forks are contained in large rectangular wooden troughs lined with gutta-percha, or made of rivetted wrought iron. They are sufficiently high to allow about four inches of liquid above the immersed object, whose distance from the bottom and sides should be nearly the same, to give a regular deposit of metal at both extremities of the object. The upper ledge of the trough carries two brass rods all round, which do not touch one another, one above the other, so that other metallic rods, being put across, will rest upon the higher or the lower rod, but not both at the same time. Each rod is connected with one of the poles of the battery by conducting wires, the points of contact of which should be perfectly clean. The rod which supports the articles to be silvered is connected with the negative pole represented by zinc in most batteries; and the other supporting the anodes is attached to the positive pole, which is carbon with Bunsen's elements, copper for Daniell's, and platinum with Grove's cells. A certain number of spoons and forks fixed to a rod by means of copper wires, are cleansed at the same time, and the rod is placed upon the negative conducting rod of the trough. Then, facing these articles, hang upon the positive conducting wire of the trough another metallic rod to which the soluble silver anode is attached like a flag. Next comes another series of spoons and forks faced by another soluble anode in such a manner that each row of spoons and forks is between two anodes. The articles to be silvered all rest upon the negative conducting rod, and the soluble anodes upon the positive one. This disposition is for obtaining an equal deposit upon all the pieces. The objects require turning upside-down during the operation, in order to prevent a thicker deposit on the lower parts, as the richest part of the solution is the densest, and therefore lies near the bottom of the trough. The denser layers being richer in metal, deposit it more abundantly upon the direction which they follow, and form grooves which cannot be filled by the lighter and poorer currents. It is, therefore, advantageous to keep the objects in constant motion. In this case the frame supporting the articles does not rest upon the trough, but is suspended above the bath, and receives its motion from a small eccentric or other motive power. The silver deposit will adhere strongly if the articles have been fully amalgamated in the solution of nitrate of binoxide of mercury and have remained in the silver bath from twelve to fifteen hours, according to the intensity of the current. The silvering will be the better and finer as the intensity of the current is weaker, up to a certain limit. A sufficient quantity of silver may be deposited in three or four hours, but the result is not satisfactory, and the burnishing is very difficult. When the articles have acquired a film of silver they are sometimes removed from the bath and thoroughly scratch-brushed, cleansed in alcohol, or preferably in a hot silvering bath, thence again passed through the mercurial solution, and finished in the former cold electro-bath. This first scratch-brushing, which is not always necessary, obviates the tendency of certain alloys to assume a crystalline appearance, and corrects imperfections of the cleansing process. Electro-silvering baths do not generally work so well when freshly prepared as when they have been used for a certain time; the deposit is often granulated, bluish, or yellowish. It is, therefore, desirable to mix a portion of old liquors with those recently prepared, or new baths may acquire an artificial age by boiling them for a few hours, or adding to them one or two thousandths of aqua ammonia.

(To be continued.)

Trade Notes.

A watchmaker named Thomas Johnson, aged 33, was indicted, for that being the bailee of a quantity of silver watches, the property of Wm. Mackay and others, he did fraudulently convert the same to his own use. There were ten indictments against him, to all of which he pleaded guilty.—The prisoner kept a watchmaker's shop at New Brentford, and received watches from several persons to be repaired, but instead of doing so he pawned them. An inspector of police informed the Court that in May last the prisoner's wife and two children had been attacked with small-pox, and the prisoner had had a great deal of trouble and expense in consequence of all three cases terminating fatally.—The prisoner implored the mercy of the Court. He said he had been deserted by his customers, who would not come near his shop while his wife and children were ill, and consequently he had been reduced to such a state of destitution that he had nothing before him but to pledge the watches of his customers. He now offered to do all in his power to restore the property and to return the sums of money for which the watches had been pledged.—After conferring with the magistrates on the bench, the Assistant-Judge sentenced him to eight months' imprisonment and hard labour.

* * *

Mr. Richard Whittaker, of 9, Hatton Garden, London, E.C., has deposited at the offices of this Journal a model watch, such as he thinks will meet the wants of our market. It is a sound looking and, as regards thickness, a most presentable watch; it has a *heavy balance, broad spring*, and a *long winding square*: and this watch, Mr. Whittaker affirms, can, by the use of machine-tools, be turned out for 38s., leaving a handsome dividend for the capital invested. If such a watch can be offered to the trade at the price quoted, or even a few shillings more, it will certainly not want buyers. The model may be inspected at our offices by anyone interested in the matter.

The Court of the Goldsmiths' Company have voted their annual subscription of £200 to the Church of Ireland Sustentation Fund, and a sum of £500 each was voted to the Irish Ladies' Distress Fund and Irish Defence Fund.

* * *

A number of watch chains are being offered. One long link and two short ones. They are so strongly gilt as to resist ordinary tests. The pledger asks £3 or £4 on them. They are worth about 10s.—*Pawnbrokers' Gazette.*

* * *

The German Emperor has recently conferred the great Prussian gold medal for art and science upon Mr. George Matthey, F.R.S., of the well-known firm of refiners in Hatton Garden, in recognition of his services in the interests of science.

* * *

According to our American exchanges, most manufacturers of watches, clocks, jewellery, and silverware, are having a good time of it in the States, many of them being compelled to enlarge their factories and increase their staff, so as to meet demand. The Dueber Watch-case Company, Cincinnati, has erected a new factory for 500 hands, and are now turning out 600 cases a day. The Yale Clock Company, New Haven, have more than doubled the area of their premises, and capacity in tools and hands. They are said to have unexecuted orders in hand for 20,000 clocks. The Terry Clock Company, Pittsfield, are turning out 8,000 clocks a month.

* * *

Some tradesmen were summoned at Manchester for selling plate without a licence. An officer of the Excise bought an umbrella from the defendants' shop for three guineas. It turned out to be mounted with more than the stipulated quantity of silver. The defendants, on learning that they had transgressed the law, immediately took out a licence, and at the hearing remarked that they thought the case a very hard one. The magistrate observed that he agreed with them, and inflicted a fine of 5s. The Excise officer thereupon asked that the defendants should be compelled to take the umbrella back, but the magistrate declined to make an order to that effect.

* * *

Morris Schott, 22, a watchmaker, was charged with fraudulently converting to his own use forty-nine gold watches, value £134, of which he was the bailee, they being the property of Victor Bonhote, watchmaker. The prisoner was apprehended at the Viaduct Hotel by Detectives Greet and Wakefield, of the G Division, when over £1,000 in Bank of England notes, gold, and silver, was found in his possession. This money, it was stated, belonged to his creditors, he having been on the previous day adjudicated a bankrupt. The information on which the warrant was granted was to the effect that the prisoner called on the prosecutor at his place of business in St. John Street Road, Clerkenwell, and said he had a purchaser for some gold watches. He was allowed to take away a box containing forty-nine gold watches, on the understanding that he was to call again, either that day or the following day; but, instead of doing so, he decamped, and none of the watches had been recovered. As the prisoner had not long been in custody no evidence was taken on this occasion, and he was remanded in order that the police might make inquiries into this and other cases of fraud which it was stated would be brought against him.

* * *

Mr. L. Hasluck, accountant, Holborn Viaduct, has been appointed trustee in the bankruptcy of Morris Schott, wholesale watch importer, carrying on business in Spencer Street, Clerkenwell. Proofs of debts to the amount of £3,000 were tendered; no accounts were filed.

The American Watch Company have declared a half yearly dividend of four per cent., which, with a similar dividend paid in February last, is equivalent to a yearly dividend of eight per cent.

At the Birmingham Police Court, Messrs. List, manufacturing jewellers, were summoned by the Inland Revenue for selling plate without a license. An officer purchased a necklet from the defendants' shop, value one pound, when complaint was made. One of the defendants said they thought a license was not necessary, as they were factors, not manufacturers. The defendants were fined £5 and costs; and several other firms were fined smaller amounts.

WM. MOORE, 40, described as a gentleman, was charged with obtaining a diamond pendant, value £300, from Messrs. Weil and Harburg, wholesale jewellers, Holborn Circus, by means of false representations, with intent to defraud. It was alleged that, in September last, the prisoner called at the prosecutors' shop, and produced the card of a gentleman known to the firm, upon whose recommendation they were induced to enter into a few business transactions with the prisoner. He represented that he expected to sell an estate, and realise £5,000 profit. In October he obtained the pendant, representing that he desired to make a present to his wife, and would return it if it was not approved. He was subsequently arrested at Bristol, upon a warrant granted under civil proceedings, and it was ascertained that he had pawned the pendant for £100 at Mr. Vaughan's, 39, Strand. The prisoner was remanded for the purpose of calling evidence of his bankruptcy at Bristol.

A List of Watches, Watch Movements, Clocks, &c.

THE PROPERTY OF THE WORSHIPFUL CLOCKMAKERS' COMPANY, AND DEPOSITED IN THE GUILDHALL, LONDON.

(*Continued from page* 68.)

BROCKBANK, JOHN, London.

Apprenticed to Joseph Hardin, 28th July, 1761; admitted Freeman of the Company, 16th January, 1769; and made a Liveryman, April 7th, 1777.

58. Horizontal Centre Seconds Movement, with going fusee, enamel dial, capped, beautifully engraved cock and name-piece. No. 1617.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

59. A Machine for calculating the distance travelled by wheeled carriages, made by the late Mr. John Brockbank for his own use, and attached to his gig.

Presented by Mr. Deputy Atkins, Clerk of the Company, sole representative of the firm of Brockbank and Atkins, 1875.

BROCKBANKS, London.

John and Myles Brockbank. (For John, see above.) Myles, the son of Edward Brockbank, of Corners, in Cumberland; apprenticed to his brother John, of 17, Old Jewry, February 1st, 1769; admitted a Freeman, July 8th, 1776.

60. Thirty-hour Marine Chronometer, about the date 1780, and has an escapement known as the cross-spring escapement, upon Earnshaw's principle, a description of which will be found in Earnshaw's Appeal, printed in 1808, and described as an evasion of his patent, with a bitter invective by the author against John Brockbank, whom he charged with having pirated his invention. No. 449.

Presented by Deputy S. E. Atkins, Clerk of the Company, and sole representative of the firm of Brockbank and Atkins, 1875.

CABRIERE, CHARLES, London (Broad Street).

Made Free of the Company in 1726; chosen on the Court of Assistants, 4th October, 1750; served the office of Warden in 1754-57; elected Master of the Company, 29th September, 1757.

61. Vertical Bell Repeating Movement. No. 2,572.

Presented by B. L. Vulliamy, 1816.

62. Gilt Movement, highly wrought scroll pillars. No. 6,017.

Presented by F. B. Adams, July, 1869.

63. Vertical Movement, with enamel dial, and chased pillars. No. 908.

Presented by Edward Streeter, 1875.

CARGUILLOT, JEHAN, Abbeville.

64. Large Silver Clock and Alarm Watch, case pierced and engraved, gilt dial, with enamel hour circle.

Purchased by the Company, for £5, at Windsor, 1848.

CARTWRIGHT, N., Lombard Street, London.

65. Plain Vertical Movement, with curiously pierced silver pillars, enamel dial, gilt pierced hands. No. 2100.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

CARTWRIGHT, THOMAS, Horologs, Principi, Londini.

Apprenticed to Christopher Gould, 4th December, 1693.

66. Vertical Movement, with crystal cock, curiously jewelled.

Purchased by the Company, for £1, at Windsor, 1848.

CLAY, WILLIAM, London.

Apprenticed to Jeremiah Gregory, 26th May, 1680; made Free of the Company 5th December, 1687.

67. Small Silver-Gilt Watch, brass engraved dial, hour hand only, made previously to the introduction of chains, box curiously chased with the old English rose, the outer case perfectly plain.

COGNIET, Paris.

68. Metal Gilt Watch, winds up by common pinion square, hour hand only, the case embossed and gilt, the subject being Apollo with his lyre.

Purchased by the Company, 1821.

CORUN, A MONTPELLIER.

69. An Ancient Vertical Movement, with enamel dial, and curiously pierced hands, with moveable slide for adjusting the escapement cock, jewelled with a ruby end-piece.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1873.

COURT, HENLEY, No. 5.

70. A Box Alarum Patent Repeater, made to receive any ordinary watch of the period, the fusee square being inserted in a hollow receptacle attached to a pinion, which, being turned by the fusee, acts upon a rack having divisions thereon, and by which it is set to the time the alarum is required to be discharged.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

CREACK, WILLIAM, London.

71. Plain Vertical Movement, with enamel dial, in pair of cases, the outer case embossed and gilt. No. 18,573.

Presented by Deputy S. E. Atkins, clerk of the Company, 1875.

CROMER, à Paris.

72. Gilt French Movement, double-pin escapement. No. 692.

Presented by F. B. Adams, July, 1869.

(*To be continued*).

ERRATUM.—On page 95, at bottom, read *turbidity* instead of *solidity*.

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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TWO ILLUSTRATED SUPPLEMENTS :—1. Designs for Modern Jewellery. 2. Antique Rings and Ornaments.

No. 81.—Vol. VII.] FEBRUARY 6, 1882. [Subscription, 5s. per Annum. Post Free.

The Future of the English Watch Trade.

By James U. Poole.

TO THE EDITOR OF THE " WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—As a practical sequel to the incident mentioned at the conclusion of my last paper, I would desire to reproduce a paragraph from the report of a lecture which I delivered at the Horological Institute, on February 15th, 1880, and published in the *Journal* the following April.

> "I cannot see that fine watches will ever become cheaper; for as technical education increases, workmen will expect to receive a higher remuneration for their labour, so as to be able to live in a manner corresponding to their improved tastes; neither can I see that our system of manufacture can be altered, because, owing to the fact that every old-established retailer has his own special style, it is impossible to obtain that uniformity which is necessary before quantities could be produced [*i.e.* by machinery]."

It will readily be seen that the foregoing paragraph contains three distinct propositions. The correctness of the first will, I think, not be disputed; but the second, referring to our system of manufacture, admits of considerable difference of opinion, because therein lies the root of the whole matter. The first essential in making good watches is to procure suitable movements, the quality of which has not improved of late years, although more attention is paid to uniformity of size, and the interchangeability of the various parts. The opinion has been put forward that movement makers ought to do more to their work, so as to reduce the labour of those who follow; but I think that the makers of medium-class keyless movements already do too much, and that certain things should be left to those who have had a special training for them. Directly they attempt to deal with the niceties of work, such as steady pinning, pitching motion depths, &c., they fail to give satisfaction, as is only to be expected from the low rate of remuneration allowed for the work. Therefore, I think that it is a mistake to suppose that the English trade is to be saved by the mere cheapening of the rough movements; and, as I have before said, if a very large number of very superior machine-made movements were produced, sufficient demand would not exist for any one style to pay for the cost of production. The British workman is a very great reality. He has a constitutional and inveterate objection to work after any one else, and, if forced to do so, will generally contrive to spoil the work of his predecessor, while at the same time, disclaiming all responsibility about his own, on account of not doing it all through according to his own ideas. The readiest illustration that occurs to my mind is in connection with the lower fusee and centre holes to keyless movements, which are frequently, for purposes of convenience, put in by a different workman to the one who finishes off the watch. No matter how well the job is done, the last party declines to allow anything for it, and intimates that he is not answerable for the consequences of working from that foundation. The same thing would apply to all similar attempts by the movement maker, and no practical good would result from the various parts being placed in the hands of manufacturers in a more finished condition than they are at present.

In the manufacture of first-class watches I attach very little importance to the idea that the sizes of the various movement makers should be uniform, or that all screws should be made to a standard screw plate. It is the business of each large manufacturer to look after his own movement maker, and in so doing the smaller ones are benefitted. It should be borne in mind that the entire trade in high-class watches is exceedingly limited, and even if it were possible (which it is not) to consolidate the entire manufacture, the cost would not be materially lessened, as is proved by the price asked for the highest grade of watches by the American Watch Company, which may fairly be taken as a standing illustration of the capabilities of the producing powers of horological machinery.

The return of the number of gold cases marked each year at Goldsmiths' Hall ought to give a correct idea of the state of the legitimate English watch trade; but an analysis will show that very much must be left to conjecture. Last year the number is stated to be 23,651, of these a considerable number would be made to repeaters, chronographs, and other complicated watches, made up by English manufacturers from imported movements.

Then, again, a large number are out-and-out foreign cases, containing foreign imitations of English movements, which are directly sold in opposition to our own make, without any benefit at all being derived by English workmen, except those who clean them. Many are made for Liverpool and Coventry manufacturers by London case-makers, and this inconsistency has been the chief obstacle towards getting any reformation in the present custom of marking cases known to be foreign made, Mr. Chamberlain rightly considering that one practice is as unfair as the other. I venture to state the number of genuine London-made first-class watches at about 10,000 annually, and a manufacturer turning out 200 adjusted watches may be said to be doing an exceedingly good business, and one which, reckoning the usual proportion of jobbing, &c., will tax all his energies to conduct in a proper manner. The usual number of such watches turned out by individuals range from 100 to 25, and the attainments of those who make the smallest number are sometimes the greatest. Calculating from the above basis, I arrive at the result that the manufacture is in the hands of at least 270 principals, divided as follows:—Five producing 200 annually; fifteen, 100; fifty, 50; and two-hundred, 25. It would be as impossible to make this number of practical horologists to think alike as it would be to make all their productions perform alike, and there is scarcely a technical point upon which great difference of opinion does not prevail. I maintain that this difference of opinion is necessary in order to keep the standard of excellence sufficiently high; and the establishment of a huge monopoly in first-class work would ultimately result in bringing discredit on the manufacture as a whole.

A manufacturer personally conducting a business of a manageable size, naturally takes more pride in it than one which is carried on by hirelings. The former is a vested interest intended to remain in a family, and not something to be bought and sold in the open market. I am here reminded of a question which is said to have been put by a sympathising friend to the widow of a celebrated sculptor, viz., whether the "business!!" was to be carried on as usual? As I before intimated in this Journal, the entire watch producing communities are trading on the deservedly acquired reputation of the genuine English watch, and it would be an equal misfortune to them if we were to abandon our position of leaders in the manufacture; but we will keep it for our own sakes, and not claim consideration for motives with which we should scarcely be credited by our competitors. There is no reason why we should *not* maintain our position; the beautiful productions of our ancestors were carried out under difficulties which, happily, we can scarcely imagine. I was lately favoured, through the courtesy of H. C. Overall, Esq., the Clerk to the Clockmakers' Company, with a private view of the original chronometer made by Mudge a century ago, the beauty of the construction of which requires to be seen to be fully appreciated.

Most of the subsequent alterations in the mode of manufacturing have been in the way of a division of labour, so as to ensure larger numbers being turned out; but now that it is obvious that the demand is a limited one, it is necessary to reconsider some of the first principles on which the trade was established. My grandfather for many years made his own balances and escapements, also, of course, the springs; there was no horological literature in those days, and each one had to depend on his own experience. I occasionally have the privilege of conversing with one of his customers, an old captain and ship owner, now a veteran of 85, who told me recently that he owned the second ship that carried a cargo of merchandise to Algoa Bay, sixty years ago, and that the chronometer was the best one he ever had. In those days good work was appreciated and paid for as it deserved to be; but the "cutting down" practices of some retailers, together with the change which has taken place in the management of our principal lines of trading vessels, introducing the pernicious "commission" system, has done much to deteriorate the manufacture of chronometers; and this applies equally to watches.

It is not, however, my desire to take an hostile attitude towards retailers, the power of whom to influence the future of the English watch trade will form the topic of my next paper.

(To be continued.)

Taxation of Silver Plate.

That the duty on silver plate is a serious hindrance to any revival or development of the silver trade is now recognised by everybody that has given this question any study; and what opposition there was formerly to this agitation has now dwindled down to about a score of obstructionists, who directly benefit by the present state of affairs.

The duty has been condemned by the enlightened section of the trade, by the press, and its fate was ultimately sealed when our able Chancellor of the Exchequer acknowledged its impolicy, and expressed his readiness to abolish it. Unfortunately, last year's Budget did not allow him to dispense even with the paltry income from this source; and as his scheme for the gradual extinction of the duty was impracticable, he had no other alternative but to postpone the abolition to a more favourable opportunity. This opportunity has now come. There is every prospect of a good surplus; a considerable reduction in the Income-tax is said to be contemplated, and we may reasonably expect that Mr. Gladstone will not forget the suffering silversmiths. The indefatigable champion of the cause of freedom in the silver trade, Mr. E. J. Watherston, will see that the matter is not lost sight of. He has already opened the campaign afresh by reading a paper at the East India Association to a large and select audience, with the result of much additional and influential support. The chairman (the Right Hon. Sir Arthur Hobhouse, K.C.S.I.), as well as a number of other speakers, expressed their opinion that the duty should be taken off with the least possible delay, and that it would not only benefit the British silver trade, but India also, by the larger absorption of silver, which would certainly follow such a great reduction in the price of silver-plate, as the removal of the silver duty would permit.

The Relation of Barrel and Spring.

By I. Herrmann.

(Continued from page 103.)

PROPOSITION (*a*).

In a given barrel, the number of rotations of the arbor in winding the spring, or of the barrel, during its development, is proportionate to the difference of the diametrical measures of the area's covert, when the spring is wound up, and when it is down.

In reality the spring forms a spiral, hence no one coil represents a perfect circle. If, however, we take the distance from the centre to any point between any two coils as radius, then two radii into 3·1416 will give the accurate measure of a coil. Now it is evident, that the number of rotations of the arbor in winding the spring is equal to the sum of the differences of the circumferences of the coils when down, and when gathered on to the arbor. This can be verified by experiment. If a spring is put into a barrel that almost fills it, the arbor will make very few turns in winding the spring. This is due to the fact, that as the coils that are to be gathered up lay very close to the surface they are to cover, the difference of their circumferences must be very small; hence, though we get a larger mass on to the arbor, the number of turns that it makes in gathering them is really less than with a shorter spring.

There is another condition which becomes a factor in diminishing the turns with a full barrel. As coil after coil is collected on to the arbor, they become part and parcel of the arbor, and thus the radius of the last turn gathered is to the following one, as the radius of the barrel arbor to the first coil. But the angle of rotation of the arbor in gathering a single coil, is proportionate to the difference mentioned divided by the radius: hence, as in equal arcs, the angles vary inversely as the radii, it follows, that at each coil the arbor must move through a smaller angle than it did in the preceding one. We see, therefore, that the angular motion of the spring is in an inverse ratio to the coils gathered.

It follows, therefore, that as we shorten the spring and diminish the number of coils, we increase the angular motion of the arbor or barrel. This holds good up to a certain point only. Suppose we apply a spring so short that it occupies one or two turns only when down, then, though the difference between the circumferences when reposing against the rim of the barrel and when coiled up is at a maximum, yet their sum must necessarily be small; hence it is apparent that there is a limit in this direction, and that the length of the spring is also a factor in the barrel rotations.

We have shown that in starting with a full barrel, by gradually shortening the spring, we increase the angular motion of the arbor; and that there is a point somewhere in its length, and if we shorten it beyond that point, the angular motion of the arbor will again diminish. Now, if we can show also, that the angular motion of the arbor or barrel in winding or unwinding a long or a short spring is in ratio of the diametrical or radial measure of the areas covered by the spring in both conditions, we shall have proved the proposition.

The respective areas covered by the spring are annuluses, and are always equal in surface measure: hence, it follows that as the diameters of this annulus diminish, the difference in their diameters or radii must increase, and that when they increase the reverse will be true.

But we have to show that the differences of the radial measure of the areas covered by the spring is in every respect similar to the sum of the circumferential differences of the coils, and that hence both are in the same ratio to the motion of the arbor or barrel.

It can be shown, that this difference is least with a full spring or with a short one, and greatest at some intermediate point.

We have already stated, that the space covered by the spring, when wound up or when down, is always equal, and that its form is called an annulus.

The area of an annulus is found by multiplying the sums of its diameters by their difference, and this into ·7854.

Suppose the radius of a barrel (inside measure) is = 1, the radial measure of the spring is = ·333, then the space covered by the spring when down is an annulus whose outside radius is = 1, and inside radius = ·666;

$$\text{hence half its area} = (1 + {\cdot}666) \times (1 - {\cdot}666) \times {\cdot}7854.$$

Let the radius of the barrel arbor = ·333, then when the spring is wound up this will represent its inside radius, and its outer will be x. Then

$$(x + {\cdot}333).\ (x - {\cdot}333) \times {\cdot}7854 = (1 + {\cdot}666).\ (1 - {\cdot}666) \times {\cdot}7854;$$

therefore,

$$\begin{aligned} x^2 - {\cdot}333^2 &= 1 - 666^2 \\ x^2 &= {\cdot}5564 + 333^2 \\ x &= \sqrt{{\cdot}667289} \\ x &= {\cdot}816 \end{aligned}$$

and the difference in the radial measure

$$\begin{aligned} &= ({\cdot}816 - {\cdot}333) - {\cdot}333 \\ &= {\cdot}483 - {\cdot}333 \\ &= {\cdot}15 \end{aligned}$$

Let the spring when down, cover one half the barrel, then when it is wound up, we have

$$(x + {\cdot}333).\ (x - {\cdot}333) \times {\cdot}1854 = (1 + {\cdot}5) \times (1 - {\cdot}5) \times {\cdot}7854;$$

therefore,

$$\begin{aligned} x &= \sqrt{{\cdot}860889} \\ &= {\cdot}927 \end{aligned}$$

and difference,

$$\begin{aligned} &= (.927 - {\cdot}333) - {\cdot}5 \\ &= {\cdot}594 - {\cdot}5 \\ &= {\cdot}094 \end{aligned}$$

Again, let the area covered by the unwound spring equal $^1/_6$, or ·1666, thus:

$$(x + {\cdot}333) \times (x - {\cdot}333)\ {\cdot}7854 = 1 + {\cdot}8334) \times (1 - {\cdot}8334 \times {\cdot}7854;$$

therefore,

$$\begin{aligned} x &= \sqrt{{\cdot}416333} \\ &= {\cdot}645 \end{aligned}$$

and difference,

$$\begin{aligned} &= ({\cdot}645 - 333) - {\cdot}1666 \\ &= {\cdot}312 - {\cdot}1666 \\ &= {\cdot}1454 \end{aligned}$$

Thus we see, that in either extreme case the difference in the diameters is least, and it can be shown, that at no ratio will it be greater than when the spring occupies ·25 to ·26 of the space. But this difference, divided by the thickness of the spring, gives the number of the rotations of the barrel arbor, hence the proposition at the head of this paper is proved.

(To be Continued.)

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Obituary.

Horological Society has lost one of its worthiest members by the death of Mr. Richard Webster, F.R.A.S., of Queen Victoria Street (late 74, Cornhill). Mr. Webster, who was in his 62nd year, had been ailing for some time past, and expired on the 28th ult., at his private residence, 57, Marquess Road, Canonbury. His interment took place last Tuesday, at Abney Park Cemetery.

Gems and Jewels—in Relation to their Biblical History.

By J. W. Singer.

(Continued from page 113)

A TEST for uncut stones is, that it is the only precious stone that becomes electric when heated by friction, attracting straws, feathers, paper, hairs, &c. No other uncut gem will do this. The weight used for selling diamonds is called a carat, derived from a seed like a veitch, and is about $3\frac{3}{4}$ of our ordinary grains. This is divided into 8ths, 16ths, and 32nds, and even 64ths; and diamonds are faceted of which it would take 1000 to weigh a carat. Many fluctuations have taken place in the value of diamonds. In 1606, at a sale by auction in Venice of the effects of a great diamond merchant, a one carat stone fetched £21 13s. 4d. In the year 1720, just before the discovery in Brazil, the price of the same weight was £8. In 1791, the commission of jewellers that valued the French Crown Jewels (and they would be sure to be of fine quality) put them only at £6. In the panic of 1848 they even fell to £5 a carat; but immediately on peace being restored, they rose to £15 for white stones. Everyone knows that a diamond sparkles, but few can tell why it does so more than other stones of the same colour. This depends on three or four causes, and unless these conditions came together, you could not have the sparkle of the diamond, and these causes come together in no other stone. First, light, in passing through it, is dispersed but little; in glass the loss is only 0·32, and in the diamond 0·38; thus, nearly all the light that falls on it passes through it. Next, it has a greater refractive power than any other substance, and nearly double that of glass. It is this refractive power that enables a diamond to be seen so much more, or in a wider space than any other stone; as if there was no refraction you would only see a ray of light when just opposite or at right angles to that light; as it is *now*, the ray enters the stone, and is then refracted at a great angle; and now comes the third great reason for the brilliancy of this stone. If it were a crystal of quartz, or of glass, in these half of the light would pass through the back, and so far be lost as to effect; but in the diamond *all* the light is reflected from the back of the stone that falls on it at any angle of incidence greater than 24·13; artificial stones only reflect half this light. And thus a ray of light is seen at one side of a room that entered from the other side of it. If sun light is allowed to fall on a diamond, and the stone is placed over white paper, there will be a dark shadow to a much greater degree than as if you put a piece of glass of the same form. For these three reasons, next the sunlight, a ball-room lighted with candles is so much better for the effect on stones than a few large lamps; and I should think the electric light the worst of all, as the light comes in one direction.

There are only about twelve large diamonds in the world, nearly all of which have an eventful history, and very many a tale could be written about them, as nearly every one has been the cause of trouble, strife, and murder to many of their former owners. The one belonging to our Queen, called the Koh-i-noor, is the tenth or eleventh as to weight, and is about an inch and a quarter in its greatest diameter. Some Indian accounts give a fabulous age to this stone; but it was for certain in the treasury of a Mogul Sultan in 1526, and has been the cause of many a war for its possession; having finally fallen into the hands of the East India Company, who presented it to our Queen about 1850. The very romance of the history of a stone is well seen in reading the career of the stone now called the "Regent Diamond" (the eighth in size) so called from having been purchased by the Duke of Orleans, then Regent of France. This stone was found by a slave, who, to hide his treasure, concealed it in a large gash that he made in his leg for that purpose until he could escape to Madras. There he fell in with an English skipper, who, by promising to find a purchaser, upon condition that he had half the profits, lured him on board his ship, and then got rid of his claims by throwing him overboard. The skipper sold the stone for a thousand pounds to a Hindoo merchant, and having soon spent the money, he then hanged himself. The Hindoo, Jamelchund, who bought it, sold the stone to Governor Pitt for £20,000, to whom it brought great trouble, and he had to write a pamphlet to clear himself from the report that he had stolen the same. Even Pope, writing about it, says:—

> "Asleep and naked, as the Indian lay,
> An honest factor stole the gem away."

A German traveller who came to London in 1712 gives an amusing account of his stay in London, and of his many attempts to get a sight of this diamond, then recently brought home by Pitt, the fame of which soon spread through Europe. But the difficulty was to get an interview with the late Governor. So fearful was he of being robbed of his troublesome treasure, that he never made known beforehand when he was going up to town, and he never slept twice consecutively in the same house, and for the five years he was owner of it his life was as undesirable as possible, until at length he sold it for £135,000. After this it was cut, which cost £3,500, and took two years in doing. This stone was afterwards stolen, with other crown jewels, in 1792. The thieves were never detected, and all were lost for ever excepting this and another jewel. A letter was sent to the Commune, telling where it was buried, and in that place it was again found. After that, Bonaparte found it useful, and pledged it to the Dutch, and used the means thus found to consolidate the new power after the 18th Brumaire.

(To be continued.)

Index to Antique Rings and Ornaments.

24—Specimen of a Saxon Wire Ring, so twisted as to resemble a seal ring. Found in the Saxon cemetery, on Kingston Downs, near Canterbury.

25—Greek Buckle.

26—Early Celtic Finger Ring.

27—Bronze Breast Pin of the Gallo-Roman period in the Museum at Boulogne.

28—The upper portion of a lady on a Monumental Sculpture in the Museum at Mayence, according to her head-dress supposed to belong to the reign of the Emperor Hadrian. The neck is enclosed by a gold necklet or torque. Upon the breast is a rose-shaped ornament or brooch, and beneath that a couple of fibulae; two more of a similar pattern fasten the upper garment near the right shoulder, and upon the left arm just above the elbow; an armlet encircles the right arm, and bracelets the wrist.

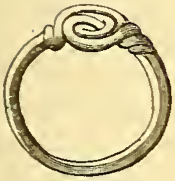
29—Roman Brooch decorated with enamel; found in the caves at King's Scarr, near Settle, in Yorkshire.

30—Plain Saxon Wire Ring, exhumed from a tumulus on Chatham Downs, near Canterbury.

31—Roman Bronze Breast Pin, as worn by the lower classes. Found at Strood, Kent, in a brickfield opposite Rochester Castle.

32—Finger Ring worn by the Gaelic ancestors, being merely a band of metal twisted round to embrace the finger, and open at either end. This specimen was found at Harnham Hill, near Salisbury.

ANTIQUE RINGS AND ORNAMENTS.



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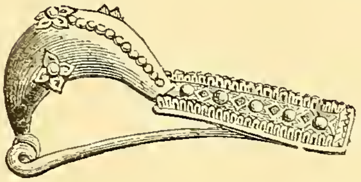

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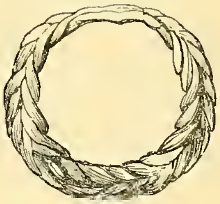

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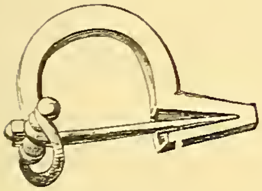

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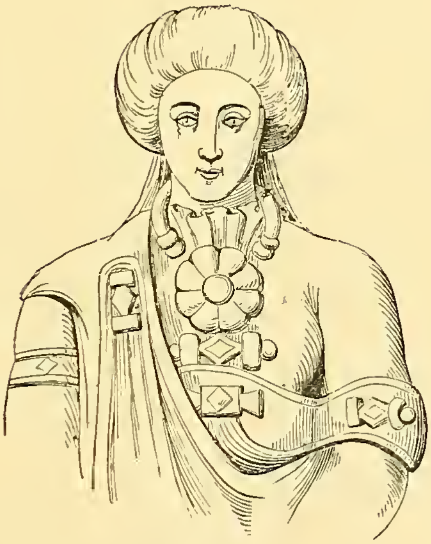

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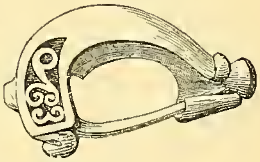

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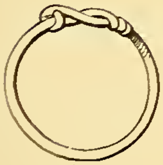

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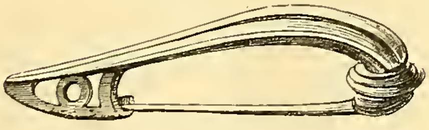

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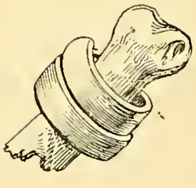

32.

For Description see page 120.

Repairing Swiss Watches.

By Hy. Ganney.

(*Continued from page* 89.)

No. XII.

To replace a broken Swiss balance staff, the repairer may procure a rough one from the material warehouse, or make one by driving a piece of steel wire into a brass collet or stopping, hardening it by heating it to a cherry red, and plunging it in oil or water; then it must be tempered by brightening a portion with Arkansas stone or otherwise, and being held near a flame and let down to a full blue: in this condition the centre must be filed in the pin vice, the arbor turned true, and the brass collet turned an approximate size. All parts of the arbor and collet must be forwarded in equal ratio, or it will come to grief if one pivot is turned nearly right size before the other arbor and back hollow has been turned sufficiently small. The douzieme and pinion gauges should be freely used on the broken staff, and if both pivots are broken, and the staff otherwise a good one, the broken staff will be a good guide for the new, and show where the shoulder must be for each pivot. The douzieme applied outside cock and foot jewels in the plate, with end stones removed, will give the length of arbor and pivots, one division of the douzieme being allowed for end shake. The arbor should be turned as short as convenient, as long arbors, besides giving unnecessary trouble in turning, are apt to get bent in polishing. When the arbor has been turned small enough, the roller must be carefully fitted in the process of polishing with cutting crocus, and the arbor must be only slightly tapered, as Swiss rollers have no pipe like the English; they must be driven on when fitted, with a brass hollow punch, the right distance, the last thing, when trying the escapement: if too tight, they will be difficult to get on or off, and if at all loose will not hold. Taking them off is not contemplated in the ordinary routine, and the rivetting clams and a punch over the pivot must be used to remove them. A very convenient stake is made by using a piece of metal with a hole large enough for the roller to go through; a slot is cut from this hole some distance to allow the arbor to pass along it, and the roller is thus supported all over at the back, and allows of force being used to remove it. This tool is very useful, also, for putting on the hair-spring collet, as the roller can be passed underneath, allowing the seat for the balance to rest on the outer face, and saves injuring the roller, which must occur if the roller itself is in contact with a stake.

Having finished the arbor, and roughly formed the part for bottom pivot, and what is called a safe, that is, turning the arbor nearly through below the pivot, so that in case of a slip or catch it may break there, we finish the collet, and fit the balance and hair-spring collet. The height from bottom of brass collet to top pivot must be carefully noted by gauging or actual juxtaposition of the old and new piece, as the eye is apt to be deceived: and leaving the rivet rather high and the collet a little too long, the inexperienced will be surprised to find that the pivot and shoulder which appeared all right is just a pivot and shoulder too high, and the pleasure of turning or breaking a new pivot and shoulder out of the rough brass and steel will show the error he has made. The excellent practice of undercutting rivets and shoulders makes them appear as long again as they are, and a good graver and skill in using it are the sure roads to success at this job, the pivots being turned nearly right size and shape with a sharp pointed graver. Then a cutting burnisher made from a piece of polished steel, hardened when made, with a rounded edge to form the conical shoulder; this, when sharpened on rough emery sticks to cut, and fine emery to burnish, will do all that is required for a perfect job in the ordinary turns. If not capable of turning anything finer than an arbor, the Jacot tool and pivot files may be used, and a nick being cut where the pivots are to be, by shifting the arbor from the large to the small nicks in the tool as it is reduced, a pivot may be worried out of the arbor with the pivot file, which will only be good enough for the commonest work. The pivots should be left full long and rounded the last thing after the balance is rivetted, so that a chance is given of improving the freedom of the balance by making the end shake and height right by shortening top or bottom pivot as may be most desirable. The rivetting should be done by a half-round punch, with the back whetted to a sharp edge nearly. This will go into the rivet and drive it down as well as out. A blow at four different parts of the rivet should tighten it flat and true, and then the hammer applied lightly to the punch, whilst the balance is continually moved with the finger, would finish it. If not flat, the rivet must be hammered at the part where the balance projects. If there are three arms to the balance, it may need flattening by striking them with a light hammer, or the pliers may be used with advantage; resting the point of the pliers near the centre of the balance on the arm, and using the edge of the balance as a fulcrum; or the balance may be held in the fingers and pressed against the edge of the work-bench to flatten it. A combination of these plans is sometimes necessary.

Escapement makers usually rub and burnish their balances on the staff before turning the pivots, by holding a pointed centre against the rivet whilst revolving in the turns; but repairers will find this not so convenient or safe as the other plan of rivetting, which must be adopted in the replacing of cylinders, and they will not get enough practice at both to be very reliable at either. Most of the directions given for the balance staff are applicable to the pallet staff, though it differs from it, being secured to the lever and pallet by screwing. Working usually in thorough jewel holes, will require a square edged polisher and burnisher to finish the pivots. The arbor has usually a very thick bottom arbor or shoulder, which is held in the pliers when it is desired to unscrew the pallets and lever. In making a new staff, a piece of steel wire may be turned whilst it is soft, and the screw made on it by using the lever itself as the screw plate; when a good thread has been formed on the arbor it should be hardened and tempered, and the height from the shoulder, on which the pallet rests. carefully gauged, and the bottom pivot made and finished, The action of the wheel on the pallets should now be observed by screwing lever and pallets together and putting them in, and holding the arbor as upright as possible; or putting the escape cock lightly on in contact with the top arbor. If the position appears right, the height should be gauged from the old arbor, or by filing a piece of brass wire until it fits between top and bottom holes, and gauging that for the height. Internal gauges may be bought which are very useful for this purpose. When the pivot is finished, the escapement should be tried first without the balance. On moving the lever and pallets, the tooth should have an equal amount of drop on to each pallet; this will prove the correct sizing and depth of the wheel and pallets, and an equal amount of run up the pallet, after the tooth drops, before the lever comes against the banking which limits its motion. If there is much run on one pallet, the other one may not leave the tooth at all, or only just as the lever comes to the rest: this shows it is out of angle, and if the steady pins are tight in pallet and lever, the hole must be opened, or the pin filed or bent to allow it to be shifted on the lever, so that the pallet may leave the tooth before the lever has travelled the full distance. If both pallets refuse to leave the teeth, it would show the bankings were not wide enough; but if the watch has ever gone, the fact proves the bankings wide enough; and inability to leave one pallet is the same effect as inability to leave both, and all alterations which makes one pallet deep makes the other shallow in the same ratio. Common levers have considerable drop, and run up the pallet as well as variable draw or retentive action of the wheel on the pallet. Fine watches allow of these actions being very close, if the wheel drops at equal distance of the lever's motion, and allows a little more motion of the lever before it comes to the banking; and then the ruby pin leaves freely, and the guard action has a little shake between the banking and roller edge, without danger of sticking in the roller, or allowing the wheel teeth to get off the locking face on to the impulse plane, until pulled off by the action of the ruby pin, the escapement being free may be considered correct.

(To be Continued.)

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Bronzes.

By C. D. E. Fortnum, F.S.A.

(Continued from page 113.)

In the collection of the Bargello, at Florence, is a representation of the Crucifixion in bas-relief of bronze, perhaps an early but a powerful work, not authenticated, but eminently characteristic of Pollaonolo, and which, although exhibiting a too impassioned action in the figures, and a too loose and fluttering drapery, is, nevertheless, of great pathos, occasionally recalling the sentiment of Botticelli, mingled with that of Mantegna.

Bartolomeo Sinibaldi di Montelupo, Andrea Contucci, and Jacopo Sansavino worked also in bronze.

Benadetto di Rovezzano, many of whose works in sculpture seemed fated to destruction, came to England in 1524, to execute a bronze tomb for Cardinal Wolsey. After five years' labour (on the cardinal's disgrace), Henry VIII. ordered its completion for his own sepulchre; his death, however, anticipated that completion, and it was laid aside. Subsequently Charles I. intended it for his tomb, but the Parliament of Cromwell ordered that the figures should be melted. Beneath St. Paul's Cathedral, Nelson's bones now lie in the sarcophagus, sole remnant of a tomb designed for the proud cardinal.

Piero Torregiano, the fellow pupil with Michael Angelo, was born in 1472. It was while working together in the Carmine that, losing temper in a dispute, he struck Michel Angelo so heavy a blow upon the nose as to crush it, and disfigure him for life. Lorenzo de' Medeci was greatly angered at this act, and Torregiano fled from Florence to Rome, where he got but poor employ in stucco work, afterwards becoming a soldier in the Papal army. Lacking advancement, he joined some merchants journeying to England, and there recommenced his artistic occupations, entering the service of Henry VII. about 1503. He undertook the monument to Henry VII. in 1518, and went to Florence for assistants. On his return, he completed the fine bronze shrine which is in Westminster Abbey. It consists of a black marble foundation, enriched with bronze pilasters bearing the king's emblems, and separating panels filled with subjects, as the Virgin and Child, and various saints, in bas-relief, of bronze. The royal armorials, upheld by children, are at the ends. On the top are the recumbent bronze figures of Henry and Elizabeth, his Queen, in long and well-arranged drapery, and the whole is caged in a Gothic chantrey chapel of open bronze or brass work of great beauty, some part or all of which was probably wrought by English hands, anterior to Torregiano's employment on the monument, for his share of which he received the sum of £1,500. An altar, also the work of that artist, was erected in front of the tomb, but was destroyed by Sir Robert Harlow. The fine bronze and gilded monument to Margaret, Countess of Richmond, also in the Abbey, is likewise ascribed to Torregiano. The simply-habited recumbent figure, with feet resting upon the Lancastrian antelope, is one of considerable excellence both in modelling and finish. From England Torregiano went to Spain, where he did some work in terra-cotta.

Before we enter upon that period when Michel Angelo's genius imbued matter with new life—too transcient, alas! and leaving a more fatal mannerism than even that which had preceded, and a darker artistic death in life—let us note the progresss of bronze sculpture in other parts of Italy. Tuscany had been the fountain-head, and even long after the decline of Byzantine influence we find comparatively little had been done in other districts. The great bronze gates, which had been so abundantly produced in Southern Italy during the twelfth, were not equalled or surpassed by works of similar or higher importance during the two next centuries. Marble was now in use, and we hear little of works in bronze throughout the central and southern states of the Peninsula. A fine recumbent bronze of Pope Innocent VII., the work of an unknown artist, is on his tomb in the crypt of St. Peter's.

In the North, during the course of the fourteenth and early fifteenth centuries, no bronze work of importance seems to have been executed, or has descended to our times. A bronze executed in 1416 by Jacophino, the then Director of the "Fabbrica del Duomo," is almost alone. It occupies a position in the centre of the roof of the aisle in Milan Cathedral, and represents the Eternal Father in *relievo*. At the Certosa are bronze doors cast after the designs of Amadeo (1447-1520), or the work of his pupils; upon which the heads, &c., exhibit that earnest and severe manner, with cardboard drapery, which is observable in many of the works of his and of the Mantegazza school. These last able sculptors, Antonio and Christoforo (*circa* 1473), were sons of a goldsmith, and therefore capable of undertaking metal work. As such, they received a commission to execute an equestrian statue of Francesco Sforza in bronze, a work which they ultimately declined, and which was subsequently taken in hand by Leonardo da Vinci. One hundred thousand pounds weight of bronze was to be devoted to this statue. In 1509, Bernardino, of Lugano, or of Milan, a clever caster of bronze, was employed by Rustici, of Florence, to cast the group of "St. John disputing with the Levite and the Pharisee," which we have already spoken of.

We have but little to record in bronze work at Venice during the earlier years of existence. With all minor objects she was doubtless supplied by her commerce with the East. We read of brazen lions from whose mouths water constantly poured into the ancient font (seventh century) of the Torcello Duomo. The right-hand door of St. Mark's is a Byzantine work, which was brought from Constantinople in 1204; and the central, of earlier date, is strongly Byzantine in character, although seemingly the work of an Italian, and inscribed in Latin. It was made by order of Leone di Molino, the Procurator, 1112. The external gates are said to have been the work of Bertuccins, about 1300.

(To be continued.)

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A patent law has been lately promulgated in Turkey. It is in substance a copy of the French and German laws. Any person may take out a patent on depositing the drawings and specifications. The longest term is fifteen years, and the annual fee is about £4. The object patented must come into manufacture in the two years following the date of the patent. The penalties for infraction are the same as in other parts of Europe.

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(Continued from page 107.)

150. After the foregoing observations on the nature of these two principal classes of keyless mechanism and their essential functions, it remains to say some words about the way in which they are applied to the movement.

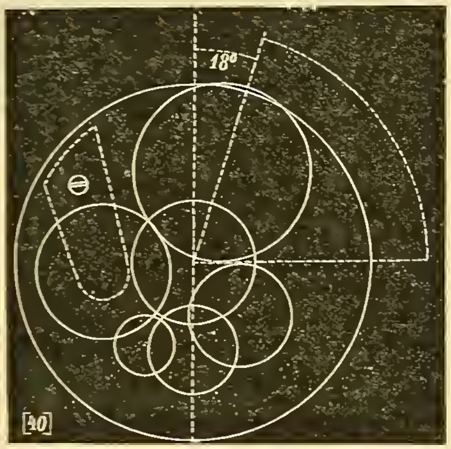


Fig. 43.

The movement delineated in Fig. 43 admits, for hunting watches, the application of the keyless mechanism without the slightest change in its disposition, except setting the pillars a little further towards the edge of the plate, in order to have the pillar-screws free of the large winding wheels. The lower pivot of the third-wheel pinion, also, will have to be set in the pillar-plate instead of the bar, because the room at this place will be required for the minute wheel.

If the winding wheels are to be level with the upper plate, this latter must be left so much thicker—a very commendable plan, because it utilizes the additional height required for the winding wheels to give greater length to the axes of the train (60). In any other respect the disposition of the movement and all its parts is the same, whether it is a keyless or key-winding one.

The arrangement of the keyless mechanism in an open-faced watch, on the contrary, is rather difficult if the winding operation is to be performed at the pendant, which is the most convenient of all the places that might be assigned to it. The pendant of an open-faced watch always corresponds to the XII of the dial, and if the watch is to have a seconds hand on an eccentric seconds dial, which is the general rule for the watches of our period, the position of the barrel with respect to the pendant can only be altered within very narrow limits, if essential deviations from the principles of constructing the train (53) are to be avoided.

In a well-constructed movement (Fig. 43) the angular distance between the pendant line and the barrel centre, taking the centre of the movement to be the summit of the angle, is about 20°; while in the same movement, when put in a hunting case, the pendant of which is at the III of the dial, this angle is $90 - 20 = 70°$, a very convenient distance for the placement of the keyless mechanism, while 20° are wholly insufficient for the purpose.

152. For avoiding this difficulty, several methods have been invented, and there was hardly any proceeding showing more forcibly the necessity under which the constructor of a watch constantly finds himself to subordinate his better knowledge to the taste and to the habits of the public. Making the keyless open-faced watches without seconds would do away altogether with the difficulty, since the place of the barrel may then be chosen quite freely, but the public want all watches with seconds.

It has been tried for a considerable period to arrange the dial in another way, so as to have the seconds dial at another place, say at the VIII or IX of the dial, but the taste of the public refused the offer, though irreproachable from the constructional point of view. Symmetry of the dial was pronounced an imperative necessity.

In this awkward position it may be called a very ingenious expedient that some manufacturers tried to establish the sacrificed symmetry of dial by adding a date hand to it, symmetrically situated with the seconds hand; but the additional cost of this dial, for which no essential want was existing, was again an objection.

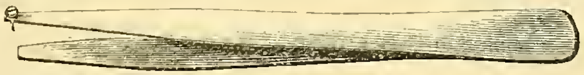
Others, again, provided the train with an auxiliary fourth pinion, serving merely to carry the seconds hand. This system realizes a sufficient distance between pendant and barrel for the placement of the keyless mechanism, with the seconds dial at its ordinary place; but it must be objected to so much the more, as it not only burthens the train with moving an additional axis, but also with the friction which must be applied to this pinion by a small spring in order to prevent the shake of the toothing being indicated by the seconds hand.

153. It is possible to increase the above-mentioned angle by adopting essentially smaller train wheels. In the generally adopted type of the Swiss manufactures this angular distance is often increased up to 30°, and even 35°, on account of the wheels being much smaller than they might have been with respect to the room afforded by the dimensions of the frame. A further increase might be obtainable by approaching the third wheel to the barrel, so as to have it go under the toothed rim of the latter, at the proper distance for leaving it just free from the cylindrical part of the barrel. But with all these various efforts and the constructive defects involved in them, it is not possible to establish sufficient room for the keyless parts.

(To be Continued.)

Improved Tweezers for Removing the Pendulum Spring Stud from the Balance Cock of a Geneva Watch.—Much difficulty and danger is sometimes experienced in pushing out the Swiss pendulum spring stud, and not unfrequently has a young beginner slipped from the stud and destroyed a good pendulum spring, causing vexatious and unprofitable delay. The accompanying sketch, which sufficiently explains itself, shews a pair of tweezers which may be made in half-an-hour, from an old pair that are worn out for fine work, which completely overcomes the difficulty. The lower lip of the tweezers is about $^1/_{16}$ of an inch shorter than the top lip, so as to free the stud, and allow the pivotted screw in the upper lip to press it out. I have seen a pair of tweezers for this purpose with a fork cut in the lower lip to admit part of the stud, also a pair in which the lower lip shifts by a spring; the latter is complicated, but all answer the purpose.

R. W.



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Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann on Monday Evenings, from October 25th.*

(Continued from p. 110).

DIAMETER OF THE ROLLER.

THE measure of the diameter of the roller is generally accepted as ¼ to ⅓, the span of two points of the long or star teeth. Apart from the principle of moment of resistance, there is a geometrical condition which sets a limit to the size of the rollers.

In every escapement the drop of the wheel is always a loss, but in the duplex we have, in addition to this, the angle the wheel moves through, from the point where a star tooth enters the periphery of the roller, to the point where it passes out of it, and becomes disengaged. Let a (Fig. 55) be the first point, and a^1 the latter, then the available impulse angle of the wheel = 24° − (a W a^1 + 2 drops).

From this we learn that, with a large roller, we reduce the virtual impulse angle of the wheel, by making a W a^1 sufficiently large, and if we make a Wa^1 small, the moment of resistance, that is a o (Fig. 55), increases.

IMPULSE ANGLE.

What has been said on the question of large and small angles in the other escapements, applies equally to this. It has to be decided by the mass and radius of balance, or the size of the watch, the number of vibrations in a given time, impulse power, moment of resistance, size of pivots, frictional contact. As already stated, we can only name the factors which form the sum "time," and point to the line along which the further pursuit of the investigation must take place. We have scarcely touched the points relating to the balance and pendulum, because they have various mechanical properties as rotating bodies, which will require preliminary treatment in a future course before we can do so.

The geometrical conditions of the impulse angle of the pallet depend on the ratio of the radius of the impulse pallet and impulse teeth of the escape wheel, and inversely these ratios are subject to the magnitude of the impulse angle.

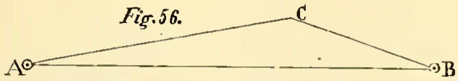
Fig. 56.

Let A B (Fig. 56) represent the line of centres of a duplex escapement. Make C A B = half the impulse angle of the escape wheel, and C B A = half the impulse angle of the pallet. Draw A C and B C meeting in C, then A C = impulse radius of impulse or vertical teeth, and C B = the impulse radius of pallet.

Within a certain limit the principle of impulse moment is that of a force acting at right angles on a lever arm; this lever arm being the pallet, and the force the circumferential energy of the escape wheel; therefore, it is evident, that the impulse moment varies in proportion to the pallet radius, and inversely as the wheel impulse radius, because if we consider the rotary energy of the latter as the moment of one lever arm, to be maintained in equilibrio by another, it follows that, as we diminish the radius, or lever arm, we increase the weight, or the impulse energy; but on the pallet this energy acts on an increasing lever arm, therefore the impulse moment progresses in a two-fold ratio.

This principle holds good in all escapements, where the impulse is given across the line of centres, such as the escapement in question, the lever and roller action of the lever escapement and chronometer, or where it is a pure combination of levers; but not where the incline plane forms an agent, as we have seen in former escapements.

We have stated that, within a certain limit, we may consider the rotary energy of the wheel acts at right angles to the pallet. This, however, can only hold good within a small angle, which is the limit referred to; beyond such a point the direction of the circumferential force of the wheel forms no longer a normal to the face of the pallet, and hence it is resolved into reaction on the pallet, and pressure on the escape wheel pivots, the former representing an increased impulse force applied to the pallet.

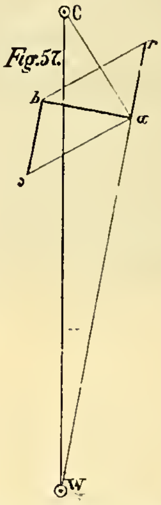
Fig. 57.

Let C and W (Fig. 57) be the pallet and wheel centres of motion, and let C a be the pallet radius of impulse contact, and W a the wheel radius of impulse contact, and C a W be the angle formed by them; and, also, let b a represent the circumferential force of the wheel in magnitude and direction, and s a the direction of the rotary motion of the pallet. Then s a, being at right angles to the pallet, will also represent the direction of the reaction on C a (Fig 23, p. 130, Vol. VI.) Draw b s parallel to a W, meeting a s in s, and complete the parallelogram b s a r; then b r or a s represents the impulse force of the escape wheel at the point a, and r a or b s the pressure on the escape wheel pivots.

We see that, when < C a b becomes a right angle, b s vanishes, and hence also the pressure on the escape wheel pivots, and s a becomes equal to b a; and inversely, when > C a b becomes very small, a s is indefinitely great. A few practical hints will be better understood after a description of Fig. 58, or the

METHOD OF CONSTRUCTION.

Draw C W, the line of centres of the escape wheel and moderator; make > a C W equal half the angle of roller contact = ½′ 35° = 17° 30′ and < a W C = half the wheel angle of roller contact = ½ 3° = 1° 30. Draw C a and W a meeting in a. With C as centre, and C a as radius, describe circle D E, which represents the circumference of the roller. Then < a C b is the roller angle of contact = 35°, and < a W b the wheel angle of roller contact = 3°.

With radius W a describe an arc d d', representing the periphery of the long or star teeth. Take a as the position of one tooth, mark off a' and a'' distant from a the $^1/_{15}$ of the circle d d'. The angle contained between any two teeth = 24°. Deducting from this the wheel angle of roller contact

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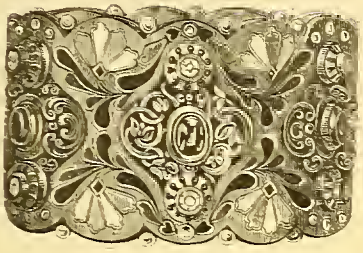
Supplement to the Watchmaker, Jeweller, and Silversmith, February 6th, 1882.

MONTHLY SUPPLEMENT OF DESIGNS.



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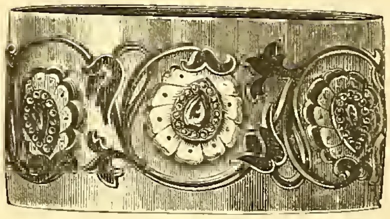

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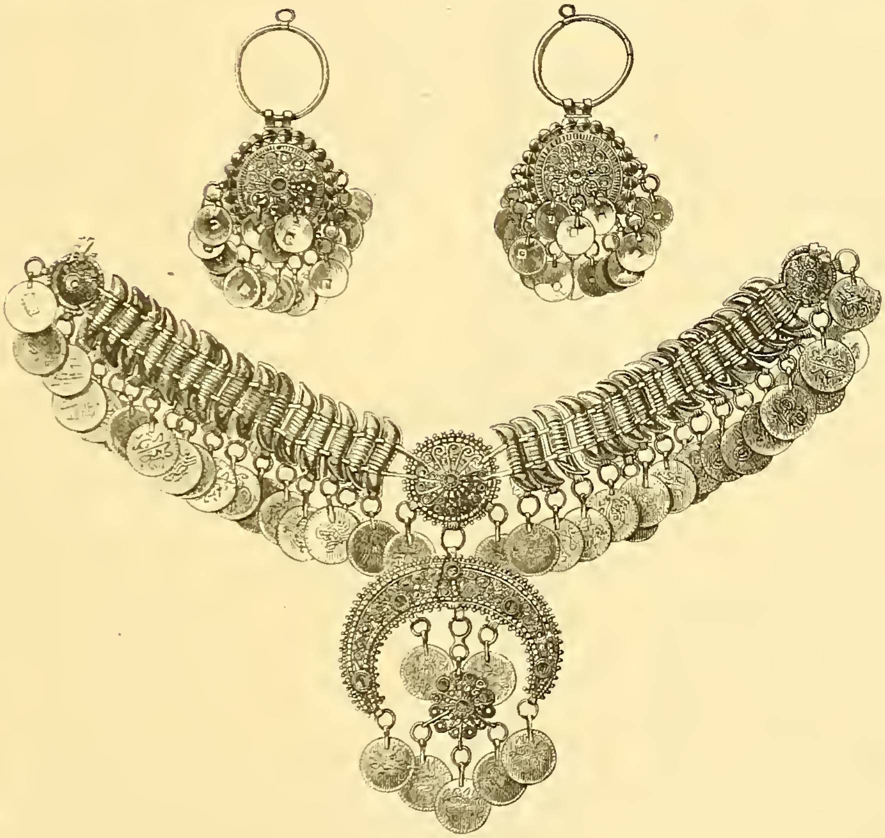

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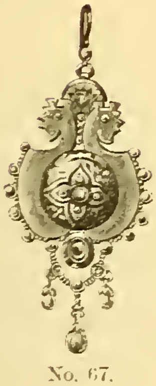

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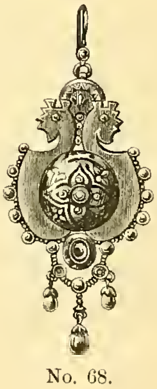

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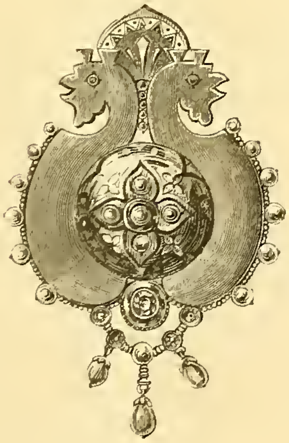

No. 69.

$= 3^\circ$, the drop on to the pallet $= 1^\circ$, and the drop off the pallet on to the roller $= 1^\circ$, the virtual impulse angle of the impulse teeth $= 24^\circ - (3^\circ + 1' + 1') = 24^\circ - 5^\circ = 19^\circ$. Make $< m\ W\ C = \frac{1}{2}\ 19^\circ = 9^\circ\ 30$, and $m\ W\ n = 19^\circ$. Assume the impulse $<$ of pallet $= 38^\circ$, and make $m\ C\ W = \frac{1}{2}\ 38^\circ = 19^\circ$, and $m\ C\ n$ equal 38°. Draw C m and W m meeting in m. With C as centre and radius C m, draw arc $o\ o'$, which is the arc of the pallet. From n W mark off $n' = 1^\circ$ and n' will be the position of a vertical tooth. Again,

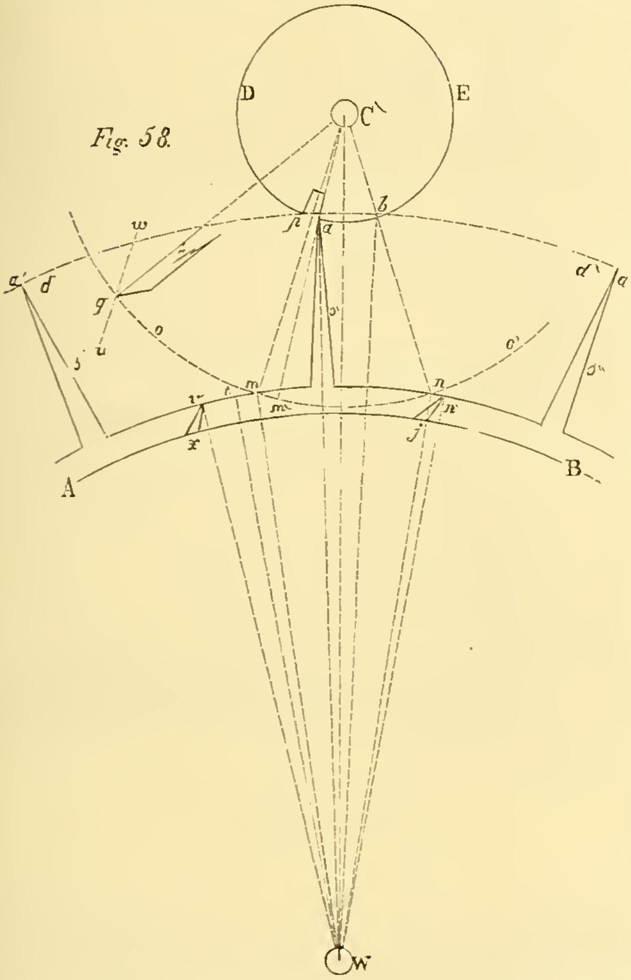
Fig. 58.

from m mark off v, and make $< v\ W\ m = a\ W\ b +$ angle of drop $= 4^\circ$, then v is the position of the adjacent vertical tooth, and v and n' will be equidistant from a' and a, and from a and a''. Now, according to this construction, the impulse contact would commence when the pallet is at point m, that is, when just penetrating the periphery of $v\ n'$ of the vertical teeth $x\ y$, which would be impracticable, for it is a mechanical necessity that tooth x should make a stable impulse contact with the face of the pallet. Hence, from m C mark off $m'\ C = 2^\circ$. It will be seen that when the front of tooth s' passes out of the periphery of roller D E at b, the point v of tooth x will be at t; hence the pallet must pass through the periphery of the impulse wheel before s becomes disengaged at b, which is effected by making m' the position of the pallet. From this it will be seen that the mechanical condition of safety makes an additional drop on to the pallet a necessity. Then the impulse angle before the line of centres $= 19^\circ - 2^\circ = 17^\circ$ and past the line of centres $= 19^\circ$ and $< m'\ C\ n = 38^\circ - 2^\circ = 36^\circ$.

From m' C mark off $> q\ C\ m' = 36^\circ$, then q will be the position of the pallet; $p\ a$ is the notch of the roller, which should be no wider than to admit a safe passage of teeth s.

REMARKS.

It will be observed, that when the side p of the notch is at a, the point of tooth s' will move forward equal to the width or span of the notch; but as the roller is moving in a direction from a to p, it follows that the point of this tooth is forced back to a. This is the recoil, and is proportional to the span of the notch.

It has been stated by some watchmakers, that in this escapement the impulse contact commences at the line of centres; but we have shown that this is an error.

In many duplex escape wheels the faces of the teeth x and y are parallel with the radius. But since there is engaging contact, it follows that the point of the pallet is moving up on the faces of teeth x, a hard point over a soft plane, which accounts for the exceptional wear of the vertical teeth of duplex escape wheels. If the faces of these teeth are sufficiently inclined or under cut that the point v moves up the plane of the pallet during the engaging contact, this evil result is avoided.

In practice, where the former exists, I have found it of advantage to give the extreme end of the pallet the form indicated by $u\ w$, thus approximating the conditions of impulse contact to those we get with an undercut tooth.

It will be noticed, that a safe penetration of pallet q into the periphery of the impulse circle of the wheel is essential. This can be tested practically by observing the angular position of any point in the balance, in relation to a fixed point in the plate, and then moving the balance back again from m towards o, noticing the position where the point q becomes disengaged from any tooth x: the difference indicates the angle $m\ C\ m'$. Likewise, it need hardly be pointed out, that the impulse is only given once in every two vibrations of the balance; hence, there is a tendency to set, which is in proportion to angle $m\ C\ n$.

This tendency is minimised by so adjusting the position of the pallet, when the tension of the balance-spring is in equilibrio, that q is close to t, and s' just about passing out of the notch at b.

THE LEVER ESCAPEMENT.

Under this heading, various forms of escapements might be arranged; but we shall confine ourselves to what is generally understood by the term "English Lever Escapement;" that is, the star teeth escape wheel and table roller.

This escapement is practically a collection of the principles we have found in the others. Thus, in the wheel and pallet we have the impulse action of the dead beat or recoil, and of the horizontal impulse action; that is, on the unlocking, the pallet propels the wheel in the same way as the escape wheel in the horizontal escapement propels the cylinder, only with this difference, that in the latter the motive power is communicated by the mainspring, and in the former by the rotary energy of the balance. Again, in the roller and lever impulse action, we have that of the duplex and chronometer, and in the guard action that of duplex and cylinder frictional rest. Since we have treated the principles involved in these actions, we need only now show their applications and combinations.

(*To be Continued*).

To make a powder for silvering, add to 1 oz. molten zinc the same quantity of mercury. Grind and then add $7\frac{1}{2}$ oz. artificial horn. When a metal is rubbed with this powder it takes at once the appearance of silver.

A List of Watches, Watch Movements, Clocks, &c.

The Property of the Worshipful Clockmakers' Company, and Deposited in the Guildhall, London.

(*Continued from page* 116.)

Debaufre, Peter, London.

Made Free of the Company, 1st July, 1689.

73. Curious Silver Watch, with original lever escapement, small crystal at back to show the balance, beats half-seconds, has stop-work, silver dial (outer case wanting): the whole in good preservation.

Purchased by the Company at Alexander Cummings' sale, July, 1815.

De Charmes, Simon, London.

Made free of the Company, 6th April, 1691.

74. Gold Double-Case Repeater, gold dial, No. 27. The case is a fine specimen of early engraving and piercing. This watch was the property of the Duke of Bridgewater, the originator of the canal called after his name. It was probably made for one of his ancestors, whose coronet (a Baron's) and cypher reversed are engraved on the back.

Presented by B. L. Vulliamy, 1849.

75. Vertical Movement, with enamel dial.

Presented by B. L. Vulliamy, 1849.

76. Vertical Movement, with pierced tulip pillars.

Presented by Edward Streeter, 1875.

Delander.

Nathaniel Delander, chosen one of the Court of Assistants April 4th, 1743; served the office of Warden in 1745–6, and that of Master in 1747. Daniel Delander and John Delander were also Members of the Company.

77. Gilt Movement, No. 488.

Presented by F. B. Adams, July, 1869.

Desbois and Wheeler, London.

78. A Metal Watch, No. 760. Late the property of Lady Frederick Campbell, who was burnt to death at Combe Bank, wife of Lord Frederick Campbell, youngest son of John, Duke of Argyle.

(The curious effects of the fire are shown upon the dial and other portions of the watch.)

Dexter, M., London.

79. Vertical Movement, enamelled dial.

Presented by B. L. Vulliamy.

Dubois et Fils.

80. Centre Seconds Movement, representing the vibration of the pendulum, silver dial.

Ducomun, Cles dit Boudrile.

81. Vertical Movement (without case), showing the rising and setting of the sun, the days of the month, and the months of the year.

Presented by B. L. Vulliamy, 1848.

Dunlop.

82. Small silver name-plate of dial of an Antique Watch.

Presented by John Grant, April, 1874.

Dupin, Paul, London.

83. Gold-chased Double-case Verge Repeating Watch, jewelled, the inner case engraved and pierced, the outer case richly and beautifully chased by Moser, the whole protected by a metal case covered with black skin, ornamented with gilt pins.

Purchased by the Company, 1818.

Eagleton, Christopher, London.

Apprenticed to Charles Halstead, 4th June, 1683.

84. Silver Watch, No. 375; silver dial, outer case tortoiseshell, pinned with silver. In good preservation.

Presented by B. L. Vulliamy.

East, Edwardus, Londini.

An original assistant at the incorporation of the Company, 1632; chosen Warden, 1638: Master, 29th September, 1645; and a second time 4th October, 1652; chosen Treasurer 11th October, 1687.

85.* Silver Oval Hunting Watch, with crystal centre, catgut.

86. Metal Watch, outer case covered with black skin.

87. A Movement, with catgut, hour-hand only driven by lanthorn pinion on fuzee arbor; an antique specimen, in good preservation.

88. Clock and Alarm, given to the Company by Mr. Williams, of the House of Commons: movement only; a very large specimen, one hand making a revolution in twelve hours. The Alarm is discharged by moving the centre of the dial, which is of silver, and elaborately engraved. The construction of the Clock is with a locking-wheel. The Alarm was struck upon a bell.

Elwood, Martin, London.

Made free of the Company January, 1687.

89. Silver Watch, curious tortoiseshell case, inlaid with silver, silver dial.

Emery, Josiah.

90. A Repeating Movement, horizontal escapement, ruby cylinder, helical balance spring, with compensation curb; No. 1,123.

Presented by Charles Frodsham & Co., 1875.

Faquillion, a Hesdin.

91. A Vertical Movement, no case or dial, the cock curiously pierced and engraved.

Presented by Messrs. Adams, 1849.

Fromanteel.

Several of this name have been members of the Company.

92. An Ancient Vertical Movement, with open scroll, engraved cock and slide, open pillars, no dial, hour-hand only.

Presented by Edward Streeter, 1875.

Gleave, Matthew.

93. Movement only, no dial or hour-wheel.

(*To be continued*).

◆

Aurogentine.—We have received from Messrs. Clements Handley, & Co., wholesale watch tool and material dealers St. John's Square, Clerkenwell, a liquid preparation for cleansing tarnished gold and silver articles, under the name Aurogentine. The solution has been submitted by us to the usual tests, with most satisfactory results, the cleansing process being most simple, rapid, and efficient. The whole operation consists in moistening a piece of cotton wool with a little of the solution, and very little rubbing will restore to the article its original lustre. A fresh piece of cotton wool is used for drying. It is well known that, after using some of the preparations in the market, the cleansed articles very rapidly tarnish again; and we consider it a most essential quality of Aurogentine that it is free from this drawback, always supposing that the goods have been thoroughly dried after its application.

Strong Cement.—Mix some finely-powdered rice with cold water, so as to form a soft paste. Add boiling water, and finally boil the mixture in a pan for one or two minutes. A strong cement is thus obtained of a white colour, which can be used for many purposes.

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* Mr. East resided in Pall Mall, near the Tennis Court which Charles II., when Prince of Wales, resorted to. He frequently played, the stakes being an "Edwardus East," as his Royal Highness called it; that is, a watch of East's making.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

(*Continued from page* 115.)

XXXIII.

To Prevent Electro-Silver Plating Turning Yellow by Contact with the Air.—This change of colour is due to the deposit, by galvanic action, of pure silver and of a subsalt, the subcyanide of silver, which is rapidly decomposed and darkened by light. It is, therefore, necessary to remove the subcyanide by one of the following methods:—1. The articles are left immersed in the bath for some time after the electric current has been interrupted, when the subcyanide of silver is dissolved by the cyanide of potassium. 2. Having smeared the objects with a paste of borax, they are heated in a muffle until the salt fuses and dissolves the subcyanide. This process anneals and softens the metal. 3. The poles of the battery are inverted for a few seconds, that is to say, the articles become soluble anodes, and the electric current carries away the subcyanide of silver in preference to the metal; this operation should be very short, otherwise the silver will entirely abandon the objects, and will coat the silver sheets.

Silver-plating Britannia Metal, Pewter, and all Combinations of Lead and Tin.—These are best placed in a solution containing a good deal of free cyanide, and the deposit should be rapid at first. The surface of the anode should be about three times that required for German silver, and the battery power strong, but not too intense. It is better not to disturb these articles in the solution at the beginning of the deposit. Afterwards they may be shifted for obtaining a uniform coat. If the articles, when they have been a short time in the plating bath, present an unequal surface, remove them and brush over again as before; then, after well rinsing, return quickly to the bath, and allow them, if possible, to remain without further disturbance.

Small Silver Bath for Amateurs.—The bath is a cylindrical stoneware, glass, or porcelain vessel. After cleansing and amalgamation, the articles are attached by clean copper wires to the circumference of a brass ring, supported upon the top of the apparatus by three or four soldered cross wires. The ring is connected with the negative pole of the battery, and the positive pole with a platinum anode, or a cylinder formed of a sheet of silver rolled round, which dips into the middle of the apparatus. The articles must be now and then turned upside-down and sideways, so that each face of the object will be in turn directly opposite the silver anode; and thus, also, the points of contact with the suspending wires receive their quota of metallic deposit. Points, edges, corners, and all raised parts, offer a more easy passage to the electric current; and, therefore, become more coated with metal. As the wear of table-spoons and forks is greater on their convex sides, those parts should face the silver anode longer than the concave portions.

Bright Lustre.—Bisulphide of carbon, in small proportion, imparts a bright lustre to electro-plated articles. Put an ounce of bisulphide of carbon into a pint bottle containing a strong silver solution, with cyanide in excess. The bottle should be repeatedly shaken, and the mixture is ready for use in a few days. A few drops of this solution may be poured into the plating bath occasionally, until the work appears sufficiently bright. The bisulphide solution, however, must be added with care, for an excess is apt to spoil the solution. In plating surfaces which cannot easily be scratch-brushed, this brightening process is very serviceable. Care must be taken never to add too much at a time.

Deposits on Solder.—The difficulty of obtaining regular deposits of gold or silver over the articles which have parts soldered may be greatly obviated by scratch-brushing those parts dry, that is, without the usual liquid employed. This renders these refractory parts better conducting, provided that during the operation no impurities are left on these spots.

Method by which the Weight of Deposited Silver is Directly Ascertained.—1. The articles are cleansed by the processes already described, then dried in saw-dust or otherwise, and weighed in a scale. However rapidly this may be done, the surface of the copper will be slightly oxidised and tarnished; to recover their former cleanliness, the articles must be plunged into a strong pickle of sulphuric acid, and then into the mercurial solution. After rinsing and immersion in the bath, practical experience will teach when it is nearly time to withdraw the articles from the solution. They will have to be weighed several times before the intended weight of silver has been deposited. 2. Cleanse the articles, and put them immediately into the bath, except one, which is treated as above, and used as a test. This piece is now and then removed from the bath to ascertain its increase of weight; and when it has acquired its proportion of silver, it is supposed that the other pieces are also finished Strongly amalgamated articles will not become sensibly oxidised during the drying which precedes their weighing. When the objects have been dried, in order to ascertain the proportion of deposited silver, they should not be returned to the bath without having been cleansed in a hot solution of cyanide of potassium (which dissolves the grease from the handling), and passed again through the solution of nitrate of binoxide of mercury, and rinsed. Alcohol may be substituted for the hot solution of cyanide; but the results are not so sure, and the expense is greater. Both these methods are tedious, and only give approximate results. 3. Remove one dish of an ordinary pair of scales; substitute for it a metallic frame which supports the articles to be silvered, and communicates through the beam and the column with the negative electrode of a battery; connect the soluble anode with the positive pole. When the articles are suspended to the frame, and are in the bath, the equilibrium of the scale is established by weights upon the other dish; add to this a weight equal to the silver it is desired to deposit. The operation will be finished when the equilibrium of the beam is re-established. This method is not mathematically accurate, but is sufficiently exact for all practical purposes. An automatic arrangement, by which the electric current may be broken at the time the articles in the bath have received a sufficient deposit of silver, is easily arranged, and saves time and metal.

Anodes.—Should the anodes become black during the passage of the electric current, the solution contains too little cyanide of potassium, and too much silver. In this case the deposit is adherent, but too slow, and the bath loses more silver than it can gain from the anodes. Carefully add sufficient cyanide of potassium. If the anodes remain white during the current, the proportion of cyanide of potassium is too great, the deposited silver is often without adherence, and the anodes lose more metal than is deposited; add silver salt until it dissolves with difficulty. When in good working order, the soluble anodes become grey during the passage of the electricity, and white when the circuit is broken. The specific gravity of the bath may vary from 5° to 15° of the Baumé hydrometer for salts, and still furnish good results. There is a simple and rapid process for ascertaining the state of the bath and establishing the proper ratio between the silver and the cyanide. About half a pint of the liquor is put into a tall glass, and a solution of one-third of an ounce of nitrate of silver in three ounces of distilled water is poured into the former, drop by drop. If the white precipitate produced is rapidly dissolved by stirring, the liquor is too rich in cyanide, or too poor in silver. Should the precipitate remain undissolved after long stirring, the liquor is too rich in silver, and too poor in cyanide of potassium. When the precipitate is dissolved but slowly, the liquor is in the best condition.

(*To be Continued.*)

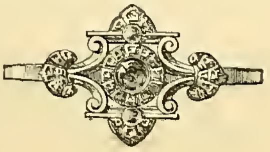
The English Watch Company.

THE English Watch Company, of Birmingham, now so well known in the trade, has so far expanded in growth as to deem it necessary to add the word "Limited" to its name. From what we have been able to learn, it is that, on account of the increase of shipping and contract orders, more plant, more buildings, and more and quicker production have become imperative. Such a combination, therefore, calls for more capital; and from the estimation in which the firm has been held, such capital ought not to be long in forthcoming.

The works are at Nos. 41 to 49, Villa Street, Lozells, Birmingham, and have been in active operation under the present management for about six years. From the prospectus, we read that the watches made are exclusively English levers, varying in style from the smallest to the largest in the market, with everything both in gold and silver cases to satisfy either the plain or the artistic taste of the public. The watches have established for themselves a sound, durable reputation in the Indian, Colonial, and Home Markets, and large orders, in consequence, continue to flow in with the revival of trade.

One very advantageous feature is, that the workshops have been specially planned for the purpose of watchmaking by steam machinery, the lighting being especially good from both sides of each shop, the windows looking out upon garden-ground. In addition to making the watches by costly high-class and automatic machinery, the several parts of the same sizes are also interchangeable. The worth of such, and style of manufacture, has been well appreciated in every quarter where the instruments have been tried. As keyless winding has taken such a firm hold of public convenience, the company manufactures that class of watch extensively. Some large orders have also been recently carried out for a powerful kind of railway and traveller's watch, that is destined to stand an enormous amount of "knocking about" and hard wear.

The capital of the Company is £50,000 in 5,000 shares of £10 each, the payment of which has been divided into the periods of application; allotment, the 1st of March and the 1st of June next. As all these will only amount to £5 per share, so confident is the vendor, Mr. William Bragge, and the directors, of increased success, that no further calls are intended to be made. Should, however, other calls be requisite, they will be at the rate of £1 a share in intervals of three months. The freehold buildings, plant, machinery, and stock in trade have been valued as a going concern, and the whole of them amount to £21,000. This, furthermore, includes the goodwill of the business, patent rights and registered trade marks. To show the confidence that there is in the matter, Mr. Bragge, the vendor, takes £11,000 of the purchase money in shares, and that such shares shall not rank for a dividend for three years, until one of six per cent. has been paid to the other shareholders. A dividend of 7½ per cent. is the estimated minimum for the new capital. There ought to be a great future in store for the English Watch Company, "Limited."



Dobell's Patent Telescopic Stud.

MESSRS. ROBERT PRINGLE AND CO., Wilderness Works, Clerkenwell Road, E.C., have just introduced a patent collar or cuff stud, which is sure to become a favourite with the trade and the public, because, by means of simple telescopic action, it secures such comfort to the wearer as is not obtainable from an ordinary stud. Dobell's Patent Stud locks the linen tightly without hurting the neck, as collar studs often do, nor does it interfere with the tie, as the stem can be shortened by the telescopic arrangement. It is certain that anybody having once worn one of these studs is not likely to be satisfied with any other, especially as its cost is very little in excess of that of a stud of the ordinary immoveable construction. Shopkeepers will do well to give this useful novelty their early attention.

Trade Notes.

GENOA is being supplied with a system of electric clocks, which will be arranged in five distinct lines, all branching out from the Municipal Palace. The first, with seven clocks, will extend to the Porta Lanterna; the second, with nine clocks, to the Molo Vecchio; the third, with nine clocks, to the Carignano; the fourth, with nine clocks, to the Palazzo Tommaseo; and the fifth, with five clocks, to the Piazza Manin.

MR. JOHN JONES (a vice-president) presided at the half-yearly meeting of the Horological Institute. The report and financial statement submitted by the council afforded evidence that the trade appreciated and encouraged the extended work of the Institute. The silver medal of the Turners' Company, offered for the best design for clock-cases, was awarded to Mr. William A. Stead, a *cabinet-maker*, who had presented his prize drawing to the Institute. There were on the books 438 members and 12 associates.

THE Court of the Carpenters' Company have voted the sum of £1,000 towards the building of the City and Guilds of London Institute for the Advancement of Technical Education.

THE City and Guilds of London Institute for the Advancement of Technical Education, give notice that they are prepared to grant a limited number of free admissions to the classes in chemical technology and mechanical technology under Professors Graham and Kennedy at University College, and also to the classes in metallurgy and practical fine art under Professors Huntingdon and Delamotte at King's College. Further notice is given that in the selection of candidates preference would be given to foremen in chemical works, artisans, apprentices, designers, and artistic tradesmen.

FREDERICK PARKER, butcher, and Albert Evans, engineer, were indicted, at the last Birmingham Quarter Sessions, for stealing, at Birmingham, on December 23rd, a wooden case containing gold chains, rings, seals, and a number of silver brooches, altogether of the value of £830, the goods of the London and North-Western Railway Company. Evans pleaded guilty to this, and also to stealing £1,000 worth of jewellery in December last. Evans was sentenced to five years' penal servitude and three years' police supervision, and Parker to fifteen months' hard labour and three years' police supervision.

At the Birmingham Police Court, Thomas Mason, lately carrying on business as a manufacturing jeweller, was charged with various offences under the Debtors' Act, 1869, by obtaining goods within four months of filing his petition and disposing of them otherwise than in the ordinary way of trade. Mr. Fitter, in opening the case, said in 1868 prisoner started in business as a manufacturing jeweller, with £100, borrowed money, which has not been repaid. He filed his petition on the 28th of October last, his liabilities being £3,257 5s. 5d., and the assets £630 16s. 8d. Since filing his petition, it had been ascertained that prisoner pawned a quantity of jewellery four months prior to the 28th of October. Evidence having been given as to prisoner filing his petition, Mr. Boulton, from the firm of Messrs. Bragg and Co., jewellers, Vittoria Street, said he supplied goods to the prisoner, which were pawned on the 23rd and 24th of September, 1881. The prisoner sent an order for jewellery on the 21st of that month, and witness identified the goods that were pawned on those dates as part of those delivered to the prisoner on the 21st of September. In answer to Mr. Plant, witness said he could not swear positively to the goods, as Mr. Marston had received several parcels of jewellery similar to those produced. He believed, however, that the whole of the goods pawned were those forwarded to the prisoner on the 21st of September. He was certain as to two brooches numbered 102 and 103. A young lady, named Edge, employed by Messrs. Bragg & Co., corroborated the evidence of this witness. Frederick Towers, manager for Mr. Wood, pawnbroker, New Street, produced three packets of jewellery which were pawned by the prisoner on the 23rd, 24th, and 28th of September last. Alfred Cowin, diamond merchant, in Frederick Street, said the prisoner purchased from him a number of diamonds. Mr. Cluice, accountant, said he was appointed trustee in the prisoner's bankruptcy proceedings. He produced a list of articles pawned that had not been entered in the books relating to the prisoner's effects. The total amount of goods pawned was £613. Prisoner had pawned within four months prior to the filing of his petition goods upon which he had received £365 15s. 1d. The diamonds purchased from Mr. Cowin were not entered in the books. Prisoner was committed to the Sessions for trial.

* * *

During the dense fog which enveloped the metropolis on Wednesday, January 25th, a robbery of an audacious character was effected at the shop of Messrs. J. S. and A. B. Wyon, Regent Street, jewellers. About noon, when the fog was at its worst, a large stone was hurled through the shop window, which is quite unprotected, and, by means of the breach thus made, a casket containing precious stones and jewellery of the value of £600 was extracted. Before the assistants could get out of the shop the thieves had disappeared with their booty in the fog, so the pursuit was rendered useless.

* * *

Benjamin Frost, 18, porter; George Frederick Stokes, 18, engraver; and Harvey Dickson, 18, groom, were indicted for stealing a bag, three diamond rings, two gold bracelets, a brooch, and divers other articles, value £80, the property of William Windust, the master of Frost; and Harvey Dickson was separately indicted for stealing ten gold bracelets, three silver spoons, a gold watch, and other articles, value together £60, the property of Jacob Moseley Joseph; and Mark Whitehead, jeweller and watchmaker, in an extensive way of business at North Street, Chichester, was indicted for receiving the same, well knowing it to have been stolen. Mr. William Windust, carrying on business as a jeweller at 22, Amwell Street, Clerkenwell, said that Frost was in his employment as messenger, and had been for the past three years, his conduct being so good that he was in the habit of entrusting him with valuable jewellery, which it was his duty to leave with various customers on what is known in the trade as "approbation," the articles being returned to the manufacturers when not sold. On the morning of the 8th December Frost started on his rounds as usual, about ten o'clock in the morning, and on his return a couple of hours later than usual in the evening, he stated that whilst on the way he had met Dickson, who asked him to collect a small account, promising at the same time to take care of his bag until his return. On coming back Dickson had disappeared with the bag, and nothing was heard of it or its contents until Inspector Peel, attached to the criminal Investigation Department, received on the morning of the 8th a telegram from Portsmouth, stating that Stokes had been arrested at Portsmouth while endeavouring to pledge some of the jewellery. Inspector Peel at once sent Sergeant Briers, who conveyed Stokes back to London, and on hearing from him certain communications, he at once took Frost into custody. The others were shortly afterwards arrested, and when Whitehead was taken into custody, he at first denied any knowledge of the greater portion of the jewellery, but afterwards stated that he had sent part of it to London to be repaired. This, however, was ascertained to be untrue, as the articles were found in his possession after his arrest. Mr. Windust was severely cross-examined by Mr. Thorne Cole, on behalf of Whitehead, to show that the price given by him for the jewellery was not much out of place, as it was a well-known fact that jewellery was sold at more than double its first cost. A pawnbroker's assistant purchased a certain portion of the property from Dickson and Stokes, and subsequently he gave information to Inspector Peel regarding the transaction. The prisoners, when pledging the articles, stated that they were a birthday gift from an aunt. Dickson was put into the witness-box, and gave evidence against the other prisoners. Mr. Forrest Fulton addressed the jury on behalf of Stokes and Frost. Mr. Thorne Cole made an energetic defence on the part of Whitehead, and called a number of witnesses, amongst them the Mayor of Chichester, who gave him a very excellent character, extending over a long series of years. The jury found Stokes and Frost Guilty, and Whitehead Not Guilty, but considered that he had acted with great indiscretion. Mr. Prentice sentenced Frost to one day's imprisonment, and to find recognisances in the sum of £10 to be of good behaviour; Stokes to be imprisoned and kept to hard labour for six months, and Dickson to be imprisoned and kept to hard labour for twenty months, and three years' police supervision.

* * *

An important legal decision has lately been given by the Master of the Rolls and Lords Justices Baggalay and Lush, in reference to Adams's patent, dated 1869, which it was alleged was infringed by the Nickel Plating Company, by whom the validity of the patent was disputed. The case had already been subject to a decision by Vice-Chancellor Bacon, who, while admitting that the possibility of the electro-deposition of nickel was previously known, upheld the patent on the ground that Adams had made it commercially successful. On the appeal their lordships were of opinion that the Vice-Chancellor had entirely overlooked the fact that the patentee himself had abandoned the first part of his claim. Under the circumstances, they held there was no evidence against the defendants to justify an injunction, and they therefore reversed the decision of the learned Judge.

* * *

The Mayor of Lille has just decided to open an Industrial Art Exhibition at the Palais Rameau, on the 15th of March, 1882, which will remain open until the 1st of June. This exhibition will also include jewellery, clocks, and watches. Any one desiring to take part in this exhibition should apply to the Secretary of the Committee, Hotel de Ville, Lille.

Mr. Weil has succeeded in depositing a layer of sub-oxides of copper on any metals or alloys with the same copper bath, an adherent and lustrous layer being obtained. These multicoloured metallic deposits are obtained at will, either united or changeable, according to the manner in which the objects are exposed to the action of the current. The different colours, which are of great solidity, are due to the presence of sub-oxides of copper, and not to an effect of thin crusts.

Mr. Bryce Wright has lately received a very remarkable historical stone. Previous to the fall of Delhi, at the time of the Indian Mutiny, and the looting which subsequently took place, this ring was kept in the Treasury of the Mogul Emperors of Hindostan, where it had been preserved for many years. The ring itself, and the back of the oval shield-shaped table which is affixed to it, is most beautifully enamelled with a floriated pattern in red, blue, green and yellow on a white ground, the whole set in an Indian gold frame-work. The face, or upper surface, of the table is composed of a floral or floriated design in green and blue enamel, having for its central ornament an engraved diamond surrounded by twelve others varying in size. The interest of the whole work centres upon this stone, it being one of the very few known diamonds that are cut or engraved; indeed, only about five are in existence, and of these it should be said that the European ones are more properly ground by the wheel than engraved by purely manual labour. The stone is the work of a Persian artist, and bears a monogram composed of two Arabic words interlocked together, making up the invocation, "O Ali."

Trade Recipes.

To Cleanse a Soiled Chamois Leather.—Many workshops contain a dirty wash leather, which is thrown aside and wasted for the want of knowing how to clean it. Make a solution of weak soda and warm water, rub plenty of soft soap into the leather and allow it to remain in soak for two hours, then rub it well until it is quite clean. Afterwards rinse it well in a weak solution composed of warm water, soda, and yellow soap. It must not be rinsed in water only, for then it would be so hard, when dry, as to be unfit for use. It is the small quantity of soap left in the leather that allows the finer particles of the leather to separate and become soft like silk. After rinsing, wring it well in a rough towel and dry quickly, then pull it about and brush it well, and it will become softer and better than most new leathers. In using a rough leather to touch up highly polished surfaces, it is frequently observed to scratch the work; this is caused by particles of dust, and even hard rouge, that are left in the leather, and if removed by a clean rougey brush it will then give the brightest and best finish, which all good workmen like to see on their work.

R. W.

The following process for manufacturing artificial pearl rests on the property of logwood extract and bichromate of potash to form with gelatine a compound which is insoluble in water:—1. Take one part gelatine and three parts water and dissolve with heat. 2. Dissolve with heat one part logwood extract in five parts of water. Mix the two solutions, pour off the excess of water, then mix one part of the logwood and gelatine mixture with two parts water. Agitate till it dissolves, and add eight parts of solution (1) so as to have excess of gelatine. Evaporate till small pellicles are formed, then cast the forms required. After one hour the casting is dipped in a bath containing one part bichrome of potash to 30 parts water, where it is left for five minutes. Artificial pearl of a brilliant black is thus obtained, which is hard and insoluble.

Among the several receipts which are given for obtaining a silvering solution, Marquard recommends the following receipt of Mr. C. Ebermacher, which has been tested repeatedly, and was found very useful as it gives, after a short time, lustrous silver layers on metals, and especially on brass. Care must be taken that the pieces which are dipped in the metal bath be treated before in the ordinary manner in a potash solution and dilute hydrochloric acid. The silver bath is made with a solution of 4 oz. lunar caustic (equal to a solution of 2½ oz silver in 7½ oz. nitric acid), the silver of this solution is precipitated as oxide of silver by the addition of a solution of 2½ oz. caustic potash in 6¼ oz. distilled water; and the precipitate, after being washed, is added to a solution of 12½ oz. cyanide of potassium in one litre of water. This solution is then filtered and water added to bring it to four litres. In this solution, which is heated on the water bath, the pieces to be silvered are left for some minutes. Being agitated, they are taken out and put to dry in fine sawdust, and then polished.

Steel may be gilded by means of a solution of gold in ether. To do this a quantity of gold is dissolved in nitro-muriatic acid, and then boiled until the liquid evaporates, when the residue is dissolved afresh in water, to which is added three times as much sulphuric ether. The liquid is then left for twenty-four hours in a bottle, tightly corked, after which time it will be seen to float on the surface of the water. If the steel is then dipped into it, it will become gilded immediately; and if designs have been painted on the surface of the metal with any varnish, a beautiful specimen of a steel and gilded surface is obtained. For other metals, the galvanic process is employed.

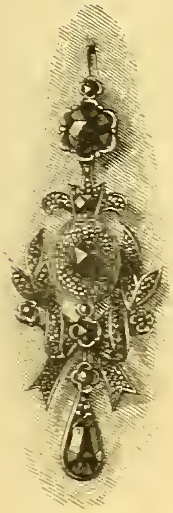
Aluminium Silver.—Is made by melting together 1 part of silver with 3 or 4 of aluminium, and is very valuable for articles in which one of the main objects is to obtain lightness, such as the instruments used for marine observations. Octants and sextants of this alloy have been received with great favour by practical navigators, those parts of such instruments which, if made with other metal, would weigh 4 lb., will, when made of the above alloy, only weigh 1 lb. Mechanics like to work this alloy, as it can be turned and filed away, which is not the case with the pure aluminium, which is too soft, and, as no doubt all know who have worked this interesting metal, it has the objectionable property of sticking to the file.

Phosphorescent Powders.—Phosphorescent powders can be prepared as follows: 10 oz. of carbonate and phosphate of lime, obtained by calcining oyster shells and sepia bones, are mixed with 10 oz caustic lime; 2¼ oz. chloride of sodium calcined, are then added, and 20 to 25 per cent. of the weight of sulphur, 3 to 7 per cent. sulphide of calcium, barium, strontium, or magnesium, which has previously been exposed to sunlight. To improve the lighting power, Messrs. Tik and Corty add a phorphorescent matter, which they obtain from the ashes of marine plants. These powders, when mixed with varnishes, render the surfaces which they cover luminous. Collodion, paraffin, soluble glass, &c., can be incorporated with them.

The following is said to be a good method for tempering very hard steel. One part wheat flour and two parts salt are mixed and dissolved in four parts water. The steel is heated and covered with a layer of this mixture, in which it is immersed. It is then heated to cherry red and placed in cold water. If the operation has been done carefully the steel will have a nice white surface.

Supplement to the Watchmaker, Jeweller, and Silversmith, March 6th, 1882.

MONTHLY SUPPLEMENT OF DESIGNS.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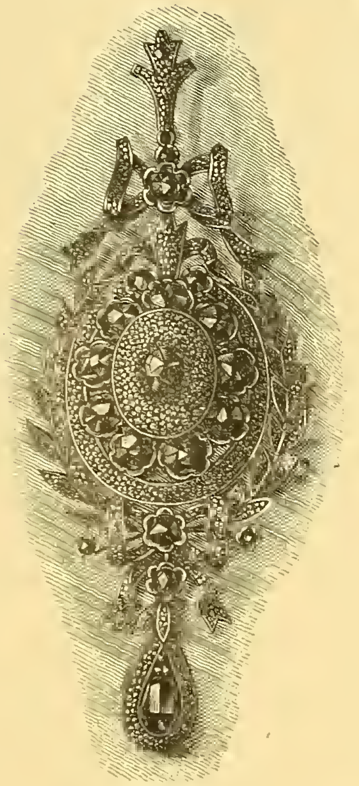
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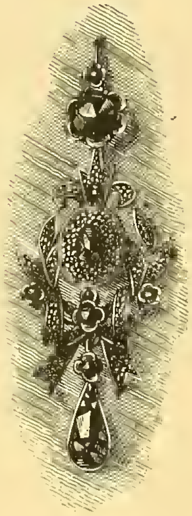
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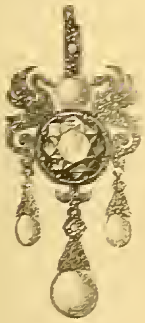
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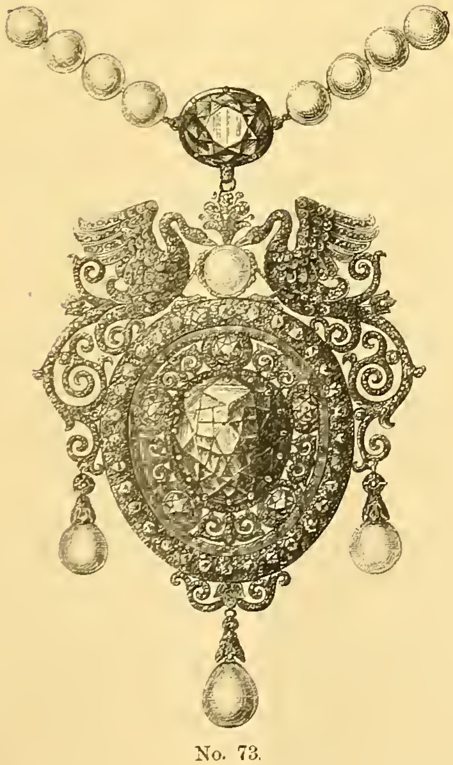
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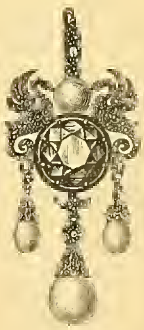
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THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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ILLUSTRATED SUPPLEMENT :—Designs for Modern Jewellery.

No. 82.—VOL. VII.] MARCH 6, 1882. [Subscription, 5s. per Annum. Post Free.

The Construction of a Simple but Mechanically Perfect Watch.*

By M. GROSSMANN, *Watch Manufacturer, Glashuette (Saxony).*

(*Continued from page* 123.)

154. For attaining this purpose, a step of greater boldness was necessary, which, notwithstanding its infringements against the principles of sound and correct construction, has been sanctioned by the trade and public, in the absence of a better expedient.

It consists in placing the third wheel pinion with its arbor quite close to the periphery of the barrel, and the necessary space for the wheel must be granted above the centre wheel. The drawbacks of this arrangement are evident; the additional height of frame required by the super-position of the wheels, and the close disposition of three large moving parts one over the other, are certainly very grave objections, but a watch is, more than many other articles, dependent upon the reigning taste, to the tyranny of which its construction must be subjected; and this must account for the fact that almost all open-faced keyless movements are disposed in this way.

It must be said in favour of this method, that all the parts of the keyless mechanism are the same, and may be indifferently used for open-faced and hunting watches, and that all the parts of the train may be executed of the same regular dimensions as in a key-winding watch of the same size.

155. If there be any way of overcoming the inconveniences in the construction of keyless open-faced watches, it must be found in the employment of another system of transmitting the winding power. As long as flat, bevel, and contrate wheels are exclusively employed, the difficulty can only be eluded by a construction just as vicious as the before-mentioned ones. A combination of an endless screw, and one or two angular gears, seems to afford a greater liberty of disposition; but I have not seen as yet a commendable construction of this kind. It seems the idea has not yet been sufficiently studied.

The source of difficulty lies evidently in the following circumstances. If the winding operation is to be performed with a certain moderate number of revolutions of the winding knob (159), a very small wheel on the barrel arbor must be selected for receiving the action of the screw; but then the place for this latter must be granted above or under the barrel, and this necessarily increases the height of the movement. If, on the contrary, the wheel in the barrel arbor is large enough to admit the screw gear beyond the circumference of the barrel, the winding would be so excessively slow as to necessitate a transmission of power by a multiplicative train.

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156. Some time ago, I combined an open-faced keyless movement with greater ease in the arrangement of the train, by having a rocking platform under the dial. The pendant and barrel are at an angle of 45°, taken from the centre, and the sizes of the train wheels are quite normal. The third wheel is fastened to a collet on the lower end of the pinion arbor, and moves in the space between the barrel head and the lower bridge. This space is quite sufficient for having the barrel and the third wheel amply clear of each other, and on the other side of the barrel the centre wheel is placed quite in the usual way. A movement on this plan is hardly any higher than a key-winder of the same breadth of mainspring.

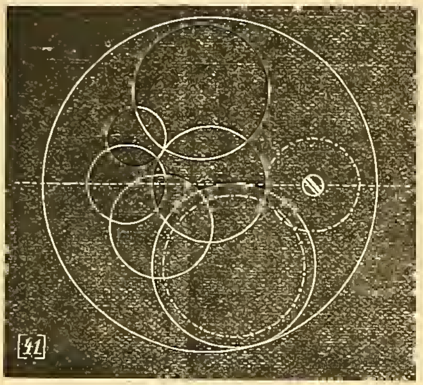

Fig. 44.

157. It remains now to speak of some other designs for winding in which the force is not applied by the pendant. There were some old watches with a kind of keyless action by turning the dome of the watch-case. This, however, has found no followers, in consequence of the impossibility of a dust-proof adjustment of the case, and because there were no means of setting the hands, except in the usual way—by using a key.

Other inventors had a circular rack, operated on by a slide projecting from the outside of the case, then winding by an intermittent or reciprocating motion.

Others, again, utilized the up-and-down motion of the front cover of a hunting-case for winding up a small part of the spring, on the supposition that a hunting watch will undoubtedly be opened a certain number of times during the day, and thus be kept a-going. It is not difficult to estimate the value of an arrangement based upon such suppositions for its efficiency. If a small number of repeated opening and shutting the case is sufficient to maintain the daily march, then the strain on the joint of the front cover of case must be excessively strong, and the consequence of it is the rapid wear of that joint. If, on the contrary, a considerable frequency of manipulations are required, this strain is less dangerous, but the device is liable to fail if the watch is not opened so many times.

158. An old and very original plan of keyless watches is still to be observed in a few specimens. In these watches, the winding of the main-spring takes place through the motion imparted to them by the walking of the wearer, and which requires a good long walk every day for being kept a-going, or, instead of this, a good while of shaking up and down.

This idea has been taken up lately by A. von Löhr, Vienna (Austria). He has completely remodelled the old watch, and improved its weak points, so that it begins to enter earnestly into the competition with the modern keyless watches. The most important of his improvements consists in a better relation between the movement of the swinging body to the quantity of winding operated by it; so that a walk of one hour is sufficient to re-wind the spring as much as it requires for keeping it a-going for twenty-four hours. Thus the daily movements of even the most sedentary person are more than sufficient for this purpose.

Besides, the better qualities of this watch (he calls it the "Perpetuale") are provided with an indicator, showing, by a hand on the dial, the actual tension of main-spring in each given moment. Should our Editor think it useful or interesting for his readers, I am quite ready to give an ample description of this interesting novelty in this journal.

159. When constructing a keyless mechanism, it is very desirable to establish a certain relation between the turns of the winding knob and those produced at the barrel arbor. In the greatest part of carefully-made keyless watches, each revolution of the winding pinion operates one-third of a turn of the barrel arbor, or nearly so. This is a proportion which ought not to be much deviated from, in whatever direction; for if a greater speed is given to the winding, the operation is too hard to perform, especially for tender fingers. If, on the contrary, the winding effect is distributed over too great a number of turns, the action will be very easy, but, at the same time, a great power is put into the hands of the person winding, and this power may prove fatal to the acting parts, if not used with the appropriate discernment. Especially the end of the winding operation, in such cases, is attended with dangers for the stop-work, the teeth of barrel and centre pinion, &c.

With the rocking-bar mechanisms, the relation of turns is simply in the ratio of the numbers of the winding pinion and the barrel wheel. But the other group of keyless works having a multiplication of speed by the flat wheel moving on the axis of the contrate wheel, the ratio between the numbers of these two must be taken into calculation. If, for example, the winding pinion has 12 teeth, the contrate wheel 24, the flat wheel on it 40, the barrel wheel 60 teeth, the result will be

$$\frac{12 \times 40}{24 \times 60} = \frac{1}{3};$$

that is, one revolution of the pinion operates one-third revolution of the barrel arbor.

160. There is another danger resulting from violent winding in those watches which have a large winding wheel with fine teeth, and the click-work acting in the teeth of this wheel. Any immoderate winding effort suddenly cut off by the action of the stop-work, and generally at the opposite end of the barrel arbor, produces a small degree of torsion of this latter, and one more tooth of the wheel is forced to pass the click. From this moment the watch acts under the influence of the full power of the main-spring, increased by the reaction of this torsion transmitted by the stop-work, and it begins to bank violently, and often continues so for some minutes. This is always accompanied with no small danger for the acting parts of the escapement, and, in case of no lasting injury to the watch, it produces a considerable deviation of rate.

Many a good keyless watch, when carefully treated, with an irreproachable rate, has been discredited by irregular performance, resulting from rough treatment in winding.

161. A very simple remedy against this inconvenience consists in giving the click a small amount of shake on its screw, or stud. The recoil resulting from this shake is sufficient to ease any torsional strain of the kind above described.

I have also made keyless watches with an extra ratchet underneath the large winding wheel on the barrel arbor, and found them answer quite well. The ratchet was taken of the size of that in a key-winding watch, and, with rather vigorous teeth, it has sufficient recoil to make up for any torsion. The room for this ratchet is abundant, and the tail of the click, if made rather long, allows for letting down the spring without taking off the barrel wheel. A click-work of this kind never causes any trouble in casing, while those click-works which are laid in the level of the winding wheels, and at the edge of the larger ones of them, sometimes are troublesome to get clear from the dome of the case.

(To be Continued.)

The Relation of Barrel and Spring.

By I. Herrmann.

(Concluded from page 119.)

PROPOSITION (*b*).

In a given barrel the unit for length and strength of the mainspring is the diameter of the barrel space.

IN a barrel, whose radius is $=1$, and the radial measure of the area covered by the spring when it is unwound $=\cdot25$, the radius of the outside turn when wound up,

$$= \sqrt{1-\cdot75^2+\cdot333^2}$$
$$\sqrt{\cdot547389}$$
$$= \cdot739$$

and as the variation in the radius would not change the ratio, it follows that for a barrel, whose diameter $= 1$, and therefore radius of space $= \frac{1}{2} = \cdot5$, the radius of outer coil when wound up

$$= \frac{\cdot739}{2}$$
$$= \cdot3695$$

Then the radial measure of the annulus, or area of the coils of the spring, which represents the rotation of the barrel or barrel arbor

$$= \cdot3695 - \left(\frac{\cdot333}{2} + \frac{\cdot25}{2}\right)$$
$$= \cdot3695 - \cdot2915$$
$$= \cdot078$$

It has to be remembered, that this space represents an extra coil. Thus starting from the hook on the barrel-arbor, it will be noticed, that when one coil is gathered up, the radial measure is equal to two coils, hence in any spiral the number of thicknesses is always one more than the number of coils. Hence, if we require five rotations of the barrel or arbor, then it is evident that the measure of the thickness of six coils $= \cdot078$ of barrel diameter unity, and therefore the thickness or strength of one coil

$$= \frac{\cdot078}{6}$$
$$= \cdot013$$

To find the length of a spring of this strength, that shall make the given number of rotations, we have to proceed thus:

The radial measure of the annulus, covered by the whole of the spring when wound up, is

$$= \cdot3695 - \frac{\cdot333}{2}$$
$$= \cdot203$$

Since ·013 is the measure of the thickness of one coil, the number of coils represented by ·203

$$= \frac{\cdot203}{\cdot013}$$
$$= 15\tfrac{1}{2} - 1 = 14\tfrac{1}{2}$$

Therefore the length of the spring is obtained by multiplying the mean diameter of the annulus into the number of coils, and this into 3·1416

$$= 2 \times \left(\frac{\cdot203-\cdot013}{2} + \cdot013 + \frac{\cdot333}{4}\right) \times 3\cdot1416 \times 14\cdot5$$
$$= 2 \times \cdot19425 \times 3\cdot1416 \times 14\cdot5$$
$$= 17\cdot6974$$

The mean diameter being increased by two thicknesses of spring becoming part and parcel of the barrel-arbor. Thus in a barrel, whose inside diameter is = 1 inch, and if we use a spring whose thickness = ·013 of an inch, and length = 17·6974, we obtain five turns of the barrel arbor in winding the spring.

Now it is evident that if we vary the thickness of spring in the same ratio of the diameter of the barrel, we retain the same number of rotations of the barrel. Again, since the number of coils would remain constant, the only factor in the length which varies, is the mean diameter of the area covered by the spring, and this evidently varies in the same ratio as the diameter of the barrel, and, therefore, the length must also vary in the same ratio; hence the diameter of the barrel is the unit for length and strength to a given number of rotations of the barrel.

From this it follows, that on the basis of the foregoing formulas tables can be constructed to barrel unity, giving length and number of turns, when strength is known, and giving strength and length when the number of turns is given.

◆

Mr. David Glasgow's American Watch.

A LETTER appeared in the February number of the *Horological Journal*, by Mr David Glasgow, describing what was supposed to be a high-class and finely-finished American watch, but which, in comparison with our own notions of high-class work, was, in the language of the writer, "coarse, and inferior from beginning to end." Now, calling attention to this particular watch was perfectly legitimate, and in the interest of the English watch trade; but, as is evident on the face of the letter, Mr. Glasgow's intention was to injure the justly-earned reputation of the Waltham watches and the American system of watchmaking; his allusion to the Melbourne Exhibition and the awards of the Jurors conclusively prove that. When we speak of American watches in this country we mean the productions of the American Watch Company, because they practically command our market in that line; and it is, therefore, no wonder that that Company should feel itself aggrieved, and demand an explanation, which brought forth the letter now embodied in the advertisement of the American Watch Company on the cover of this journal. The least we can say of Mr. Glasgow's first letter is that it was injudicious, and most unfair to a foreign competitor. This is not the British method of dealing with opponents, and although trade spite may influence a few, the trade and public at large will consider the action of the Vice-President of the Horological Institute as mean and contemptible. What should we say if some great foreign authority were to write a letter condemnatory of English watches on the strength of one rubbishing instrument that had by chance come under his notice?

The manufacturers of our chief branches of industry do not meet foreign competition by abusing their rivals, but with the manly courage for which they have always been famous; they set to work and introduce reforms in their methods of manufacture as will again enable them to show a bold front. Would it not be more advisable for Mr. Glasgow to use his influence and undeniable skill in this direction? It is not surprising that the Clerkenwell watch trade is going from bad to worse when the leaders approach the struggle in such a narrow spirit, and utterly ignore the signs of the times. Instead of infusing new life into the trade, they are gradually crushing out what little there is left of it.

◆

☞ "The Future of the English Watch Trade," *by* Mr. J. U. Poole, *will be continued in our next. Pressure of business prevented the author from completing the Paper in time for present issue.*

Watch-Name Forging.

FALSIFICATION of the character of watches, by putting names upon them for the purposes of roguery, is carried on to an extent that is hardly comprehended by the public—hardly even by the trade itself. The state of the law is greatly to blame for this; the tender care for the free trade of rascality which such a state shows, has called forth strong observations from more than one learned judge upon the Bench. If watch "christening" was made as dangerous as bank-note forging, there would, in the natural order of crime, be comparatively little of it; but when scoundrels can be readily found who will, for the sake of the order, put the most eminent horological names in Europe—more especially in London—as well as fictitious names, upon their productions, what is to be expected save what we have got. But there is even an aristocracy of watch forgers, as there is an aristocracy of picture forgers and of old silver-plate and china forgers. They would "scorn to do anything dirty—they have a conscience!" A conscience, quotha! Upon one of these humanities being asked what the article was like, and what it did for its livelihood, he triumphantly exclaimed, "Its business is to keep warning me against being found out. If it was not for the 'glorious uncertainty of the law,' there would not be a chance for us in this world at all!"

And what a history of joy and sorrow is circled round that much-used expression! and how appropriately it came into existence! How often do we use it, yet how little do the majority of us know whence it arose! It is related of it that in the year 1756, Lord Mansfield, the Lord Chief Justice of the Court of King's Bench, had overruled several ancient legal decisions, and introduced many innovations in practice, much to the astonishment of the legal world of that day. A dinner, arising out of these changes, and partly in praise of them, was given, when both judges and counsel attended. The principal toast of the evening was, "The glorious uncertainty of the law." The dinner and all connected with it have long since passed away, but the "glorious uncertainty" remains, as we have said, to protect knavery and all its kindred.

In the making up of watches to carry forged names, several niceties have to be attended to, according to the character which the article is intended to bear. As an illustration of what we say, we may mention that very fair work indeed is always put into the best class for the purpose of the more easily deceiving the retail dealer, some instances of which we will state further on.

These observations, so far, have been made to lead up to some proceedings at the Liverpool City Sessions.

Two men, one a jeweller, and the other a publican's assistant, were indicted for obtaining money by false pretences; and this is the way in which they managed it. It appears that they "opened an account" with one Edward Kirby, a watchmaker, of Coventry, and obtained the requisite amount of "stock" from him. The watches were next named with fictitious names, the cases bearing the Chester hall-mark of the three wheatsheaves and dagger. The false names were put forth as those of Liverpool makers. Set up in this style, they opened the campaign upon the usual ground, namely, that of the pawnbrokers.

One of the prisoners, being a jeweller and dealer, was able to throw the pawnbrokers off their guard when he chose to "operate," by introducing the watches in trade language. But he had a deputy, a publican's assistant, whose bungling, we may add, led to the collapse of the swindle. This assistant, being duly "furnished," went into the shop of Mr. R. Shorrock, of Roscommon Street, and offered in pledge for £3 a watch that he declared to be "a six-guinea one." Mr. Shorrock, having examined the article, and finding that it was properly numbered, and bore the name of "C. Cooper, Liverpool," and had the Chester hall-mark on the cases, lent 50s. upon it. In carrying out this fraud, the "assistant" described himself as a wine-merchant in Scotland Road. The swindler was very well "got up" for his venture, whilst a "wine-merchant" is sometimes a desirable gentleman to know. After Mr. Shorrock had parted with his money, he bethought him—stable-door-locking fashion—now that the horse was gone, of doing that which he ought to have done before; he consulted the Liverpool Directory. The investigation did not close with satisfactory results. After having victimised Mr. Shorrock, the "assistant" paid a visit to G. A. Andrews, of Netherfield Road North, where he "commenced business" by placing a watch on the counter, giving a name for the owner of the article, followed by his own as the pledger. It would appear that Mr. Andrews required a little more seasoning up than his brother tradesman, for the pretended wine-merchant showed a post-card to him, to the effect that it pressed for payment of a bill, which pressure was the cause of the pawning in hand. This watch bore the Chester hall-mark, and the name, "Henry Williams, Liverpool," as the maker, the number being "5,603," all right and regular-looking.

Mr. Andrews, however, did not snap at the bait, as was expected, but immediately called in the aid of the Directory. No such name as "Henry Williams" being found there in the watch trade, he said, "You are duffing with these watches." The false wine merchant exclaimed, with all the anger of offended dignity, that he was not; to which Mr. Andrews repiled, "It is dirty work, but better dressed men than you have done such work before." It then occurred to him that as the shop of Mr. Shorrock was not many yards off, it might as well be inquired as to whether any call had been made upon him. He was, therefore, privately sent for, and in a few minutes returned in the company of a policeman to await eventualities. These were not long in developing themselves. The jeweller—the man who carried the bag and supplied the "assistant"—was found awaiting his confederate, and they were both taken into custody. The "jeweller" said that he had sold the watches to the assistant for the last-named to do "what he could with them." Upon arrival at the police-station, the searcher found upon the "jeweller" both the money and ticket that the "assistant" had obtained from Mr. Shorrock for the watch pledged with him, and the following "goods":—Eight silver and four gold watches, a number of tickets relating to watches that had been pledged, and a mass of correspondence with Coventry watchmakers relating to negociations about this nefarious trade! Here was an exposure, and the first question that suggests itself is, who are the "Coventry watchmakers" who are bidding to be criminal participators in such "dirty work?" But why need we ask? Unless we could put them in the dock or convict them in the witness-box out of their own mouths by cross-examination, they are so protected by the law of libel that no paper would dare to publish a single name without running the risk of an action for damages!

Mr. Jackson, a watchmaker, of Liverpool, gave evidence that the cases were good, but that the movements were worthless. The value, at the outside, was not more than 35s. each watch.

Edward Kirby, the maker of the watches, told the Bench at the magisterial hearing that he had supplied them to the "jeweller," who ordered different names upon them, and he put those names on. He said that "he could put on any names that he thought proper. It was a common practice to do this, and it improves the appearance of the watch." He priced them at 45s. each.

At the trial, Mr. Aspinall, Q.C., the Recorder, expressed surprise that the maker, Kirby, had not been included in the indictment along with the two prisoners. He held him to be more responsible than the prisoners were. The prisoners having pleaded guilty when arraigned, Dr. Commins, the counsel for the prosecution, told the Recorder that the reason why Kirby had not been indicted was that they had found it necessary to use him as a witness.

The Recorder had Kirby into the witness-box, and told him that he held him to be much more responsible than the men in the dock. He was doubtless the originator of the crime, and if he had been indicted and convicted he would most probably have had twelve months' imprisonment, and a good experience of the treadmill. He (the Recorder) would not allow him any costs, and he hoped that he had not got any. The police-officer in charge of the case answered that Kirby had £3 for travelling expenses.

The Recorder said that he was very sorry; and well he might say so. In summing-up, he alluded to the propriety of both prisoners having pleaded guilty, remarking that their offence was not only one against the criminal law, but a serious moral crime. He was not at all sure that the prisoner who had bargained with Kirby for the watches was the real principal in the transaction. He regretted that the prosecution did not deem it wise to make the attempt, at least, to hold the manufacturer liable; for although he put the blame on one of the prisoners, it was probable that he himself was the originator; at all events, he got the most profit. He deliberately put upon the watches names which he knew did not exist. That would have been enough to have convicted the whole three of conspiracy, and the Recorder regretted that that course was not adopted. Even if they had run the risk of the two men escaping, it would have been much more important to have convicted Kirby than the prisoners in the dock.

It appeared that there were a number of other cases of a similar character that had not been proceeded with, upon which the Recorder expressed surprise that so many as twenty-two Liverpool pawnbrokers, whom he had always believed possessed shrewdness and a power of valuing the goods brought to them, should be imposed upon by watches which were said to be of no value. It was a matter which he was unable to comprehend. The gravamen of the charge appeared to be the putting of fictitious names on the watches, which was much more the act of the manufacturer than the prisoner. He considered that the justice of the case would be met by ordering the prisoner who had the watches from Kirby, the maker, to pay a fine of £20, and the other prisoner a fine of £5.

Thus ended this scandalous case. But a few more words are wanting to complete the moral.

A travelling dealer recently went into a shop to sell watches. As we have said, there is an aristocracy in this "dirty work," and we now come upon it. Amongst the "patterns" for sale was an 18-size gold keyless chronograph, compensated, fully jewelled, and "adjusted." Of course, the compensating balance and the jewelling could be seen; but, as we all know, the adjustment could only be ascertained by trial. Although the article was shown as second-hand—not coming direct from the maker, it presented all the appearance of not having been wound up a dozen times. The chronograph started, and stopped, and flew back to zero in admirable style—in fact, quite delightful to behold. The dial, too, was all that the most fastidious wearer could desire, and bore upon its face the name and trade-mark style of numbering of one of the foremost horologists of our time. As the shopkeeper had a customer whom such an instrument would suit, a bargain was struck, and an exchange at once made. The shopkeeper sold it to his customer a few days afterwards with the usual proviso—that if it was false to its name and parentage it was to be handed back to the tradesman, and the price paid for it returned. Away hurried the customer to test what looked like a prize, when, alas, and alack-a-day, it was instantly pronounced to be a forgery! The firm whose name was upon it said that, so far as the appearance of the case and dial went, it was a passable and deceivable imitation; but the balance and springing, and what was between the plates —faugh!

This may be taken to be a type of cases, and further space need not be occupied with the details. We have information before us that some extensive supplies for the "duffing" line have recently been turned out from some of the "dark" Coventry studios; they are intended for the manufacturing towns of Lancashire—probably have been distributed there already. So far, however, from being exhausted, "the cry is, still they come." We are told that they are all intended for the pawnbrokers; so that the useful representatives of the great Medicis of Lombardy had better hoist the storm-warning. The watches that have been got up expressly to cheat them are 18-size, about an inch and three-quarters across the dial, in 3oz. silver cases, engraved side, and shield on plain back. They are three-quarter plate, centre-seconds, chronograph dials, composition joints and stop work. There is another class similar to the Liverpool-pawned ones, and very good-looking going barrel ones. The prices in Coventry are—chronographs, 45s., intended to be pawned for 60s.; the next class, 37s., to be pawned for 50s.; and the going-barrels, 20s., to be pawned for 30s. to 35s.—all as near to those figures as can be obtained.

We repeat, that the law is much to blame for all this. We could give the names of the black sheep in Coventry who make and dispose of these watches; but unless we could be sure of having a jury who would believe that we had acted for the public good—a great risk, as some juries go—and more money than we knew what to do with, we should be insane to run our heads against an action for libel. If it were not for the almost unsinkable buoyancy afforded by the law of libel, rascality would have very shallow water to sail about in. What is wanted is a penal law, rendering punishable any watchmaker who names a watch for persons not absolutely carrying on business at the address handed to him.

The exposure which has been now given will, we trust, serve to put all the members of the trade who may read it thoroughly upon their guard, and when they can "land" a case of imposition, to prosecute it without mercy.

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Gems and Jewels—in Relation to their Biblical History.

By J. W. Singer.

(Concluded from page 120.)

THE Diamond is not now much searched for in India (the great seat of its early production), but for the last fifty years have mostly come from Brazil. When first brought from America, great efforts were made to assert that these stones were not really diamonds; so the Brazil merchants turned the tables on the buyers, by first exporting them to Goa, and then re-exporting them to Europe. The labour of searching for the stone in Brazil is all done by negroes, who dig out beds of rivers to a depth of ten or twelve feet in the dry season; and then wash the soil in the wet season. Great care is required to prevent stealing, as the slaves are always trying to get the stones, and so will conceal them in their mouth, in their ears, their hair, between their toes, and even a two-carat stone has been put in a man's eye to carry it off. When a slave finds a stone 18-carats weight, he receives his freedom, and his head is crowned with flowers. But so small is the return, usually, that the result of 500 men working for a year, can be carried in one hand, and ten thousand stones are found, to every slave released. But the findings of all other countries sink into insignificance compared to the late finds in Africa. There the discovery has been so great as to cause a revolution in the value of all but the whitest and purest stones. These latter are almost as dear as ever, as comparatively they are more scarce than before, seeing that nearly all found in Africa are coloured stones, having all sorts of names to distinguish them from white stones, and are thus called "Cape-whites," "Bye-waters," "Off-colours," "Yellows," &c. It is said that there is "nothing new under the sun," and so it seems even about the African diamonds. Nothing was ever heard of them until a trader, John O'Reilly, coming from the interior, stopped at a Dutch farmer's house, in 1867, and there saw the children playing with some pebbles, found long before. One of the stones attracted his attention, and picking it up, he said, "That might be a diamond." The farmer laughed, and said he could have it, for there were plenty of them round there. Reilly was not to be laughed out of his idea, and said he would take it down to Cape Town, and see what it was, and if *good*, he was to return half the sum to the farmer. On his way down he stopped at an hotel, and there showed the stone, and proved that it would cut glass. They laughed at him again, doing the same thing with a piece of flint, and then threw the diamond out of the window, as no good. Reilly, however, had still faith, searched for, and found his stone again, and at last got to the coast; and on showing the stone to Dr. Atherstone, it was pronounced to be a diamond, of 22½ carat weight, and finally sold for 3,000 dollars, which, one is glad to say, was divided with the farmer, Van Nickerk, and all the world became alive to the great discovery. And yet on the old maps of this part of the country, probably prepared by the Missionaries, and published in 1750, across this very track now called the Diamond Fields, is written on the old maps "*Here be diamonds.*" Still for a hundred years no one thought of looking, although it was on the high road of the Dutch pioneers, and hundreds of waggons had passed for years within a stone's throw of the largest diamond mine in the world; and they watered their horses at a shallow lake, where the farmer built a hut, from the mud-plastered walls of which diamonds were afterwards picked out. For a long time the find of diamonds at the Cape was so great that at least three hundred thousand pounds' worth were sent to London every month, until they became a drug in the market and the Bankers' safes were full of them. It would be far too long to speak of other stones; and Rubies, Emeralds, and Pearls must not now be thought of, but I would only say that the tale told by Pliny of Cleopatra dissolving one of the pearls of her famous earrings, and worth many thousands of pounds, must be a fable, as nothing that she could drink would dissolve the pearl. Her only way would have been to crush it, for that purpose; but the wily Queen is supposed to have swallowed it whole, for deception.

Jewels have always played a very important part in the history of the world, and they have been used in every possible way—often to the ruin of many; thus the Duke of Buckingham's dress coat cost him £80,000 and his life; but even his luxury was nothing to that of the Romans, where even the ladies had a kind of jewelled garter, of which Sabina the younger had a pair costing £40,000. These were not for fastening stockings, as the Romans did not wear them, but for attaching a kind of fine linen drawers; and the Romans generally wore jewels far beyond our ideas of decoration with them.

In finishing, I am sure you will think my little say must want a good deal of foiling, to make it pass for even dull paste, and beg to express my best wishes for this good society, whose end seems to be to seek that which is said to be like a pearl above price, and more precious than rubies; and will conclude with a miner's epitaph, at the Cape of Good Hope, in which the technical language is of the mine, and is not intended to be in any way profane:—

> "Here lies a digger, all his 'chips' departed:
> A 'splint' of Nature; bright and ne'er downhearted.
> He worked in many 'claims'; but now, though 'stumped,'
> He's got a claim above, that can't be 'jumped.'
> May he turn out a pure and spotless wight
> When the great Judge shall sift the wrong from right;
> And may his soul, released from this low Babel,
> Be found a Gem on God's great 'sorting-table'."

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

(*Continued from page* 127.)

XXXIV.

Burnishing.—By burnishing, the roughness of an object is flattened down until the surface is smooth and polished like a looking-glass. Burnishing is an important operation for electro deposits, which consists of a multitude of small crystals, with intervals between them, and with facets reflecting the light in every direction. The deposited metal is hardened, and forced into the pores of the underlying metal, and the durability is thus increased to such an extent that, with the same amount of silver, a burnished article will last twice as long as one which has not been so treated. The instruments employed for burnishing are made of different materials, and must be of great hardness and a perfect polish. Such are hardened cast steel, agate, flint, and blood-stone. For metallic electro-deposits steel and blood-stones are especially employed. There are several qualities of blood-stone; its grain should be close, hard, and without seams or veins; it should leave no white lines on the burnished parts, nor take off any metal, and its colour should be of an intense black red. The steel must be fine and close-grained, and perfectly polished. Should the polish of any burnishing-tool alter by use, it is restored by friction upon a skin or leather attached to a wooden block, which is fixed to the bench. The leather is covered with polishing rouge in impalpable powder, or, preferably, with pure alumina, obtained by calcining ammonia alum in a forge fire. Venetian tripoli, rottenstone, tin putty, emery, or many other hard substances finely powdered may be employed. The burnishing-tools are of various shapes, such as a lance, a tooth, a knife, a half-sphere, or a dog's tongue, and a considerable stock is necessary. The burnishing is divided into two distinct operations. The first consists in roughing, and the second is finishing. The tools for the first have a sharp edge, whilst for the second operation, they have a rounded surface. The tools for the hand or the lathe are fixed by copper ferrules into short round wooden handles, so that the hand is not influenced by their weight. The tools for the arm or vice are fastened to wooden handles sufficiently long to rest their slender part upon the arm or shoulder. The stouter lower portion is grasped by the hand. The burnishing-tools and the objects must be frequently wetted by certain solutions, some of which facilitate the sliding of the instrument, or with others which have a chemical action upon the shade of the burnished articles. Of the first are pure water, solutions of soap, decoctions of linseed, and infusions of the roots of marshmallow or liquorice. The second includes wine-lees, cream of tartar, vinegar, alum in water. When burnishing gold applied upon electro-deposits of copper, as is gilding with a dead lustre by that method, use pure water, for fear of producing a disagreeable red shade. A solution of green soap is sometimes preferred by operators, although, when old, it imparts an unpleasant tinge, owing to the sulphides of the liquor. When the burnishing is completed, the surface is wiped longitudinally with a soft and old calico rag. The polish obtained by burnishing is called black when it reflects the rays like a mirror; and should the presence of mercury or a bad deposit prevent the tool from producing a bright surface, the object is said to be greasy. Articles which have been previously polished, and which generally receive a very trifling deposit, are not burnished, but rubbed with chamois leather and the best polishing rouge. Too thick or too rapid electro-deposits cannot be burnished, but must be polished by rubbing with a leather and a mixture of oil and powdered pumice-stone, tripoli, or tin putty. Coarse powders are used at the beginning, and impalpable ones at the end of the operation. Polished silver deposits are more agreeable to the eye than burnished ones, but the hardening of the latter renders them more durable.

To Dissolve Silver from Silvered Articles.—Cold Bath.—For dissolving silver in the cold, the objects are hung in a large vessel fitted with the following mixture:—Sulphuric acid, 66° Baumé, 10 parts; nitric acid at 40° Baumé, in which they remain for a greater or less length of time, according to the thickness of the coat of silver to be dissolved. This liquid, when it does not contain water, dissolves the silver without sensibly corroding copper and its alloys; therefore, avoid introducing wet articles into it, and keep the liquid perfectly covered when not in use. As far as practicable, place the articles in the liquid so as not to touch each other, and in a vertical position, so that the silver salt will fall to the bottom. In proportion as the action of the liquor diminishes, pour in small and gradual additions of nitric acid. Dissolving silver in the cold is regular and certain, but slow, especially when the proportion of silver is great. The other more rapid process is then resorted to.

Hot Bath.—Nearly fill a flat pan of enamelled cast-iron with concentrated sulphuric acid, and heat to a temperature of from 300° to 400° Fahr.; at the moment of using it, pinches of dry powdered saltpetre are thrown into it; then hold the article with copper tongs in the liquid. The silver rapidly dissolves, and the copper or its alloys are not sensibly corroded. According to the rapidity of the solution, more or fewer pinches of saltpetre are added. All the silver has been dissolved when, after rinsing in water and dipping the articles into the cleansing acids, they present no brown or black spots—that is, when they appear like new metals. These two methods are not suitable for removing the silver from wrought and cast-iron, zinc, or lead; it is preferable to invert the electric current in a cyanide bath, or to use mechanical processes. Old de-silvering liquors become green after use; to recover the silver, they are diluted with four or five times their volume of water; then add hydrochloric acid, or common salt. The precipitation is complete when the settled liquor does not become turbid by a new addition of common salt or by hydrochloric acid. The resulting chloride of silver is separated from the liquid either by decantation or filtration, and is afterwards reduced to the metallic state by one of the methods which will be described.

(*To be Continued.*)

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Resilient Escapements.

For the sake of young readers, I may explain that the term Resilient (Latin, *resiliens*: leaping or starting back; rebounding) Escapements is the name given to those escapements in which the back of the fork, after it has been struck by the ruby pin, owing to the increased arc of vibration of the balance, moves out of the circuit or path of the ruby pin, and by means of a spring the lever immediately returns to its former position. The object of the escapement is to get rid of what is known as the banking error. I will explain what is meant by the banking error, and in so doing will refer to two extreme cases of it. Some time back I repaired several watches known as Yate's Patent, of Preston. They were made, I believe, by Messrs. Quilliam Brothers, of Elizabeth Street, Liverpool. They had very large and heavy balances, and very slow trains, 7,200 beats an hour. I found these watches keep excellent time in hanging and laying, but immediately they were put in the pocket and carried, the motion of the body frequently exceeded that of the balance, which gave it an impetus and caused it to vibrate more than 700 degrees, and so strike the back of the fork, and cause the watch to gain enormously on its rate, sometimes twenty, forty, and even one hundred minutes per day, which made the watch quite useless. In mentioning this bad characteristic of Yate's Patent, I ought not to omit a good characteristic of this watch. It is this: the slowness of the train reduced the friction of all the parts to a minimum; and while it is difficult to get a main-spring *strong* enough to a watch that has a heavy balance and 18,000 vibrations in the hour, so I found it difficult to get a main-spring *weak* enough in order to avoid striking the banking in Yate's Patent. The other example of banking error to which I will refer is in a best quality American Waltham keyless, which had a light balance and quick train, 18,000 beats per hour; there being no stop work to the watch, the extreme tension of the main-spring caused the balance to bank furiously, and in one minute the watch gained about fifteen seconds, though it was a first-quality adjusted watch.

Make the escapement resilient, and so remove the banking error, and you will open a new era in watchmaking. At the present time there are several forms of resilient escapements which I need not describe, *save* that they all contain one fault, viz., the fork is so arranged that when the increased vibration of the balance causes the ruby pin to remove the fork, until the ruby pin rests on the point of the fork, it will then stop the watch, and an escapement with such a defect is of little or no use whatever.

For some months past a controversy has been going on in the pages of our esteemed contemporary, the *Horological Journal*, respecting Mr. Schoof's resilient escapements, and the main defect has not yet been pointed out. The controversy has reference for the most to the rotary energy of the fourth and escape-wheels. It is with a desire to eliminate this defect that I have directed attention to it; I am of opinion it can be overcome, and it would be a great boon to watchmakers.—R. W.

* * *

Repairing Cheap Clocks.—There are few things that tax a workman's patience and ability more than repairing common clocks. The low prices that are paid for them, and the exacting demands that are made for their performance, render it increasingly difficult. Among the most troublesome that I have found is the French drum clock with short pendulum. The most frequent cause of its stopping is this: the back pivot, just above the pendulum, soon wears flat, which increases the friction and stops the clock. The cheapest and best remedy is to file up the pivot to a knife edge or V shape, which will give it a light action. Hoping this hint may be useful to the reader.—R. W.

Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann on Monday Evenings, from October 25th.*

(Continued from p. 125).

WHEEL AND PALLETS.

WE have now to show the principle of the exception of this class of pallets, to the rule applicable in clock escapements (see p. 62, Vol. VII.). If a force acts on a surface, the reaction is always perpendicular to that surface, and is independent of the angle at which the force acts; that is, its direction is constant, but its magnitude inversely proportionate to the angle.

If a plane is moveable about any centre, and a force acts at any angle to its surface, we shall have equilibrio if the direction of the reaction passes through the centre of motion, and the moment of the plane about this centre is proportioned to the radius, and the angle of the radius with the direction of the reaction.

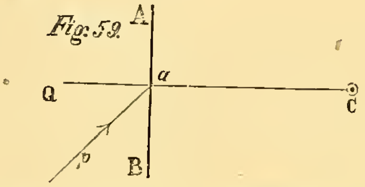

Fig: 59.

Let the plane A B (Fig. 59) represent the locking face of a pallet, moveable about its centre C. Let p represent the circumferential force of the escape wheel; then a Q is the direction of the reaction, no matter what angle p makes with A B. Let a C be perpendicular to A B, then Q a produced, would pass through C, and no increase in the magnitude of p could produce motion about C, that is, conditional that the force acts along the line p a.

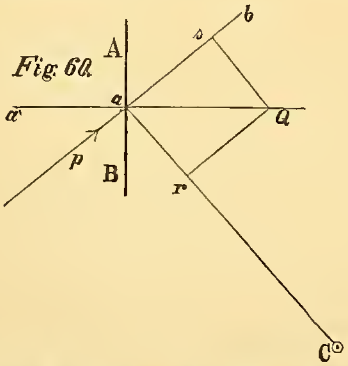

Fig: 60.

Let Fig. 60 represent the same conditions as Fig. 59, except that the centre of motion is in C and the line of direction of the reaction Q a a' makes an angle with C a. Now it is evident, that if the plane A B moves about C, it must move in the direction of ab. But we have to show that the moment about C is proportionate to $\angle$ Q a C.

B is nearer C than a. Assuming A B to be smooth, the point of application would move from a to B, by forcing the plane, A B, in the opposite direction—that is, the direction ab. Let a Q represent the magnitude and direction of the reaction of p; then aQ is resolved into two components—that is, ab acting at right angles to a C, and a force acting along a C. Draw Q s parallel to C a, meeting a b in s, and complete the parallelogram asQr. Now it is evident, that when $\angle$ C a Q becomes equal to o, then a s vanishes; and, as $\angle$ Q a C approximates to a right angle, as becomes equal to a Q; but a s represents the force which tends to turn A B about the centre, C; therefore, we have shown that the moment is proportionate to angle Q a C.

From this fact we learn, that in lever-pallets, the moments of opposite pallets, taken at different positions, vary.

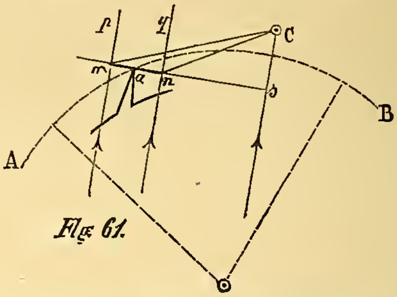

Fig. 61.

Let A B (Fig. 61) be an arc of the periphery of an escape-wheel, and a a tooth in contact with a driving plan m n, of a pallet, whose centre of motion is in C. Produce m n to s, and draw the perpendicular Cs. Now, we have shown that when the pallet has rotated about C, so s is brought to a, the moment about C = o, because the direction of the force at s is normal to n s, and passes through C. Again, at m, m p represents the direction of the reaction, and at n, n q; but $\angle$ C m p is greatest at m, and vanishes at s. Hence, as the tooth, a, moves along the driving plane, m·n, the moment varies inversely as the angles C m p and C n q, and as the radius, m C and C n—that is, on the engaging pallet, the moment diminishes as the tooth moves from the locking edge to the delivery edge. Now, the reverse follows in the disengaging pallet.

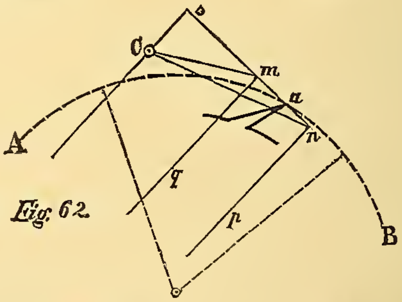

Fig. 62.

Let A B (Fig. 62) be an arc of the periphery of an escape-wheel, and let a represent a tooth in contact with the driving plane m n, whose centre of motion is C. Produce n m to s. Supposing that tooth a acted at s, then C would be in the line of direction of the reaction, and, as has been shown, no motion about C could follow. Now, m q and n p represent the direction of the reactions at points m and n, and the moment about C is proportionate to angles C m q and C n p, and radius C m and C n. Therefore, it is evident, that in the disengaging pallet the moment increases, as the point of the tooth moves from the locking to the delivery edges. Since then we see, that in the engaging pallet we obtain the greatest moment, when the line of centres is least, because then the angle formed by the direction of the reaction on the pallet with the pallet radius of contact is greatest, and that on the disengaging pallet we obtain the least moment when the line of centres is at a minimum, because then the angle formed by the direction of the reaction on the plane with the pallet radius of contact is smallest, and that the two moments vary in an inverse ratio, it is evident we shall do something towards their approximation, by making the line of centres as small as the stability of the pallet will allow.

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By a similar process of reasoning, we can show—indeed, we have shown, in Fig. 60—that on the engaging pallet the locking resistance diminishes as it penetrates the periphery of the wheel, because, at a certain angle, we obtain the conditions shown in Fig. 59, and that on the opposite locking, the effect is reversed, because then the conditions shown in Fig. 60, by which the plane A B is turned about its centre, are favoured. Hence, though in equidistant lockings the radii are equal, yet the moment of resistance cannot be so, when they have respectively penetrated the periphery of the wheel—that is, with two degrees of locking on either pallet, we should have a smaller angle and smaller radius on the engaging pallet, and the reverse on the opposite. But on the engaging pallet we have less lacking resistance and a smaller moment, and on the disengaging pallet we have more locking resistance and greater impulse moment. Hence, considering the balance in motion, we obtain an approximation of the algebraic sum—that is, the difference of the loss and gain of balance moment on either pallet.

Since then, we can adjust the locking planes, so as to offer equal locking resistance, but cannot so readily adjust the driving planes, so we obtain equal moments, it appears that circular pallets are more serviceable, because they approximate more to an equality of moments. It may be advisable to gather up these elements, and show them in their application, before we pass on to the lever and roller actions.

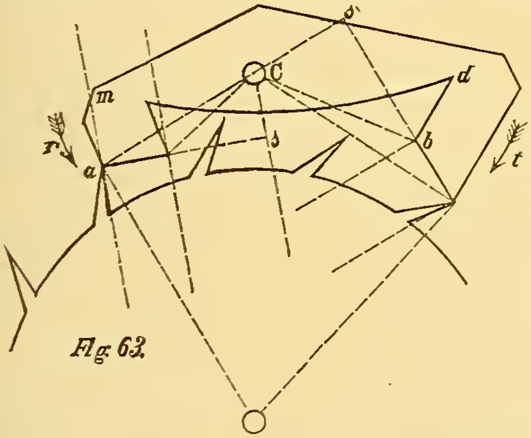


Fig. 63.

Let Fig. 63 represent a complete pallet, with equidistant lockings—that is, with a C equal to b C. $\angle$ $m\,a$ C is $= 80°$, and $\angle$ $d\,b$ C $= 100°$, and when a and b are in the periphery the angles formed by $a\,m$ and $b\,d$, with the directions of the circumferencial force at this point, are equal, and, therefore, the resistance equal. By comparison of these conditions with Fig. 60, it will be readily seen that, at a the pallet must be drawn in the direction indicated by arrow r, and at b in the direction indicated by arrow t.

Again, it will be readily seen that as $a\,m$ penetrates the periphery, $\angle$ C $a\,m$ increases, and as b penetrates the $\angle$ $d\,b$ C; it has to be remembered that a C and $b\,c$ here represents the direction of the circumferential force of the wheel. Hence the results as we have shown. The pallet radius of contact diminishes from a, and increases from b, therefore, the moments progress in an inverse ratio. Since we diminish this progressive variation somewhat by bringing C as close to the wheel as possible, it is evident, that, in small pallets, the tangentical position of the centre C is more a geometrical convenience than a mechanical expediency, since C can be brought closer, and that with advantage. It is not difficult to conceive (nor is it away from the truth) the section of $a\,m$ and $b\,d$ in contact with the points of the teeth, representing horizontal teeth, and the point of the teeth the lip of the cylinder. The conditions are parallel, and the analogy may assist in grasping the principle. We have to refer to this again in connection with

THE LEVER AND ROLLER ACTION.

The conditions of impulse, within a certain limit are identical with those of the duplex—viz., those of a force acting perpendicular at the end of a lever arm. This lever arm is represented by the impulse radius of the roller, which is equal to the distance of the centre of the ruby pin from the roller centre, and the force, by the circumferencial force of the lever at the point of contact.

In the duplex, we have seen, that the impulse moment increases as the impulse angle, but here we have the reverse the case.

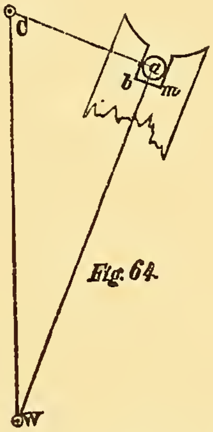


Fig. 64.

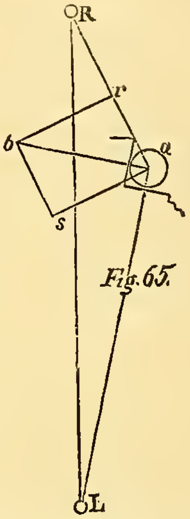


Fig. 65.

Let C and W (Fig. 64) be the centres of motion of a lever and roller, a the ruby pin in the notch of the lever b, and in such a position that their respective radii make a right angle, then it is self-evident that, in this position, no energy of the lever can turn the roller about its centre, and that as it approximates to this condition the moment is proportionate to the angle of contact on either side of the line of centres.

Again, it will be noticed that the roller radius is constant, and that the lever radius increases; therefore, with a larger angle, the lever has less rotary energy, and that force is resolved into pressure and roller impulse moment, so that the latter varies inversely as the angle, and the former proportionate to it.

Let L and R (Fig. 65) represent the centres of a lever and roller, and R a and L a their respective radii of contact, and let $b\,a$ represent the rotary energy of the lever at the point of contact. Then $b\,a$ is resolved into pressure, which acts parallel to R a, and into a component, which tends to turn the roller about its centre. This component has a direction which is at right angles to R a = $a\,s$. Draw $b\,s$ parallel to R a, meeting $a\,s$ in s, and complete the parallelogram $b\,r\,a\,s$; then $b\,s$ or $r\,a$ represents the pressure on the ruby pin, and $s\,a$ the force acting at right angles to R a. It is plain, that the latter is equal to $b\,a$ at the line of centres, and vanishes when $\angle$ R a L becomes 90°; therefore, we have the maximum impulse moment when the lever and roller radii are in or near the line of centres. It is therefore a loss, to have a large impulse angle to the balance with this impulse action.

(To be continued.)

Repairing Swiss Watches.

By Hy. Ganney.

(Continued from page 122.)

No. XIII.

TO replace a lost roller to a Swiss lever, it will be necessary to procure or make a rough one from soft steel; and, having opened it with a broach to fit the arbor, the edge of the roller should be turned away until it is the right size, which may be found by placing it in the watch without the balance cock at first; and when there is shaking or freedom between its edge and the lever guard-pin, or the part of the lever which does duty for it in Swiss watches, the cock may be put in to test it properly, but care must be used. If the roller is left too large, there will not be room for it, and the pivots will be bent or broken. By using a little judgment in observing the freedom, which is always greater than in English levers, on account of the larger lever and roller used, no trouble need be incurred; and, in first turning the roller (which must be done on the extreme point of a fine arbor, or it will break the arbor), by holding it without removing from the arbor, the point of which is held in the jewel-hole chamfer, it may be turned quite free at once, as both lever and roller are so close to the bottom plate. The position, when held in the hand, is quite accurate enough for the purpose. In most works on watch work I have noticed as peculiar that elaborate means of finding proportions and appliances for accurate production are indicated, which, however valuable to the manufacturer, are useless to the repairer, as only a capitalist could possess them, and no single lifetime would be long enough to acquire skill in their use. The watch-jobber must depend upon his file and mother wit for most of his success, and his bow and turns, well used, will never be surpassed, and seldom or never equalled, by the most elaborate lathe ingenuity can devise; and as these have been sufficient in the past for the highest specimens of new horological ability and accuracy, the watch repairer will do well to place his chief every-day reliance upon them for his poor imitations of them. He can seldom hope to equal them, as the chief merit of much excellent work is the use of simple means by a specialist, whom practice has made perfect; and the most perfect theory of watchmaking can never be reduced to practice, however useful and enlightening its study on paper may be, as actual differences which occur in watch work are too minute to be ascertained by figures or tested by mechanical appliances, or there would be no need for watch-jobbers or examiners. But the value of exact methods and machinery is not to be despised, as my experience tells me that the bulk of English manufacturers pay as many shillings for skilled examination of the work as the American factories do pence, with an inferior result on the average; and our Swiss friends seem to depend on the jobber entirely for the examination of most of their work. Luckily there is no fine or imprisonment for sale of watches unfit for consumption, and manufacturers can console themselves with the thought that their excellent work is always spoilt by the jobber, whose principal amusement it is to punch up holes and hammer out wheel-teeth for the fun of the thing. I am not disposed to admit American claims to rival Continental and English excellence in the highest firms of horological ability, a trading corporation not being able to train or secure the individual zeal and devotion of horologists, who are artists first, and traders only from necessity, amateurs being unknown in this art. In other walks, wealth can always find ignorant admirers, who *will* perceive merit; but horology is as inflexible as destiny, of which time is a part. A king once tried his hand at it, and, in disgust, left his crown for a convent, having discovered his own insignificance. Had he done something which only wanted other people's appreciation, he would never have made the discovery. Had he only scraped a fiddle, history would have recorded a greater musician than Paganini. The mere attempt to challenge European rivalry in this art is one of the wonders of American civilisation; and the fact that they can produce a larger number of watches in a given time that will answer the purpose and make less demands on the public purse or the jobber's patience is but proof of the value of American ideas and institutions. The fact that in various holes and corners of the Continent and England whatever is done by them can be done by others, is no answer, and would be as erroneous as crediting an author with all the merits and ability involved in printing and publishing his works. I have always had an idea that there is very little difference in what men *can* do: the difference consists mainly in what they *actually accomplish*. The practised workman, if a specialist, avoids elaborate and intricate calculations, and is able to get through his work by the fineness of his touch and the keenness of his vision, which, by constant practice, has become more reliable than the fine gauges which others, less practised, must use to check their labours. Not that I have any great respect for specialists; their value is entirely commercial, and they overrate their own capabilities. Let a man want a job done by a specialist, and, if it deviates but a hair's breadth from the usual routine, in shape or intention, the specialist will tell you it is impossible to make it answer. Inventors observe this; and they—not the specialist—construct balances, springs, and escapements which beat all previous efforts, and demonstrate not only the inventive superiority, but actual superior skill, at his own branch, which should make specialists more modest and less arrogant in the presence of general ability, which employs them, because it has more original, and, consequently, more profitable work for its own brains and fingers. In talking to specialists, I always find they take it for granted they alone have any knowledge of the subject, and are great believers in trade secrets which are as patent to general observation as the sun at noon. Their secrecy arises from their paucity of knowledge; but all is vanity, and without some vanity we might not trouble ourselves with working, or even with living, if we realise too keenly our own inconsequence.

To finish our roller, we can take the depths of balance and pallet holes in the tool, and, making a mark through the lever notch with red stuff, to represent the ruby pin, see that it stands fairly in the notch, and free of the bottom. A hole should be drilled, and, bearing the broach in the requisite directions either side, an oval hole must be opened until it takes a brass pin, right size and shape, that fits the notch fairly. Then the crescent, to allow the passing of the guard pin, must be filed out; and, if the roller pin and lever act right in the tool, it may be tried in the watch; if right, the brass pin must be pushed out, and a garnet oval pin inserted, rather large than small, as it is little trouble to file and polish the lever notch if too tight; and, if loose, a large portion of the impulse is wasted. The roller must be hardened and tempered, and the edge well polished and burnished. It need not be brought to a sharp edge, as is usual in Swiss watches, as this only helps the sticking of the roller and lever. The edge is intended to prevent the passing of the guard pin, and the more there is of it the better it will do it; but our Swiss friends never seem to see it, and have some hazy notions about diminished friction, when friction is what is wanted at the right time and place, and friction is not diminished by diminishing surfaces in contact. Friction is dependent on pressure, and all acting surfaces in watch work should be left as large as possible to distribute the wear and friction over as much material as possible.

(To be Continued.)

Trade Notes.

THE casket destined to contain the Address presented to the Prime Minister by the Corporation of the City of London in September last was inspected by a number of visitors at the establishment of the Goldsmiths' and Silversmiths' Company in Regent Street, to whom the Corporation have entrusted the design and execution of this work of art. The substance of the casket itself is gold, upon which are various designs in enamel, while the base upon which it rests, and which takes the form of a series of steps, is silver. It is about 12 in. long, 8 in. broad, and 10 in. high. On the reverse front there is a trophy supported by the City dragons, and bearing the following inscription:—"To the Right Hon. W. E. Gladstone, Prime Minister of England, as a token of the estimation in which he is held by the citizens of London, and of their appreciation of his high character, rare genius, and varied gifts, so long devoted to the service of his country. September 22, 1881." The front of the casket has in the centre a monumental trophy, bearing upon it Mr. Gladstone's crest, arms, and motto, surrounded by a wreath of laurel in enamel. Approaching this trophy on either side are four figures executed in repoussé work, and representing respectively the City of London with a mural crown upon her head, the City mace in one hand, while with the other she is presenting an address; Commerce holding a caduceus, indicating the prudence and energy of business, and at the side an ancient anchor showing the important part of navigation in promoting commercial success; Ceres, indicating plenty as the result of the policy of free imports; and Ireland represented by a figure holding the Irish harp in one hand, and the shamrock in the other. On the lid are the arms of the City, delicately wrought in enamel, and above it there is another trophy surmounted by the lamp of learning, with the owl as the bird of wisdom perched on the handle. The shields of the trophy represent the Genius of Patriotism, the Royal Standard, the Union Jack, and the bust of Homer, for whom Mr. Gladstone's predilection is well known. At the corners of the base are four gold figures, representing Eloquence, Justice, Industry, and Law. The work is exquisitely finished in every detail, and may fairly be described as a most tasteful as well as costly present.

* * *

A new barometer, automatically recording the variations on an enlarged scale, has been invented by Marshall Delaey. It has the following arrangement: The barometric tube, having a capacious reservoir at top, is fixedly suspended. The cistern is a tube slightly wider and nearly as long; it bears on one side an index, and on the other a pencil working on a moving cylindrical surface, and it forms the upper part of a kind of areometer, having a downward extension in the form of a closed tube floating in mercury in a wider tube which communicates below, through a U-tube, with a wide and shallow covered cistern, the level in which is approximately constant. The variation of pressure is marked by the variation of the height of mercury in the reservoir, and this latter is to that of the total height in the barometric cistern (or to the path of the float or of the pencil) in the ratio of the section of the cistern to that of the reservoir (a sixth in the instrument the author represents). Thus an amplification is realised.

There is a man, says the *Pawnbrokers' Gazette*, now sending young women with a locket, and brooch and earrings to match, in the shape of a horseshoe, to pledge. The locket is silver, and the other articles metal. He can also produce pawn-tickets showing where he has pledged them.

* * *

Gold Alberts are being offered, stamped 15,625 on every link, in imitation of the Hall-mark. They are about 8 carat coloured. Pledgers ask from £4 to £5 on them.

* * *

We are informed that an influential Company, having Messrs. Marshall Jewell, Charles E. Mitchell, Morris F. Tyler, and Robert Wheeler Wilson on their Board, and with all their capital privately subscribed, has just been formed in America, to be called "The Standard Time Company." Having carefully examined into the various systems of synchronising clocks in use both in America and Europe, the one in use in London, and known as Barraud & Lund's, has been adopted by them. A gentleman was specially sent over to England to the patentees, negotiations were at once opened, communications cabled, and the whole concession concluded in a few days. The arrangements include the whole of the American Continent as well as the United States, and an effort will be made to bring about a concerted system of Time Signalling over the whole of the States; local affiliated Companies are to be formed, and we shall probably soon hear of our Transatlantic cousins having once more excelled us in an extensive exchange and utilisation of Time Signals, as they have in their Telephonic exchanges.

* * *

"All that glitters is not gold," applies, alas! to the celebrated and supposed golden axe, the present of the King of Ashantee to Her Majesty. Some Peeping Tom has found out that the weapon is only of iron, overlaid with the more precious metal.

* * *

According to a writer in the *Pharmaceutische Zeitung*, a room covered with a paper, in which ultramarine has been largely used, was found to have an unpleasant odour of sulphuretted hydrogen, the source of which long escaped detection. It was ultimately found that the ultramarine in the design was being gradually decomposed by the alum forming an ingredient in the paper-hanger's paste.

Sale of Antique Silver Plate.

DURING the last century, a banker, equally celebrated for his wealth, his parsimony, and his complete contempt for everything of an intellectual or artistic nature, once caused some surprise among his friends by declaring that his whole life through he had been an assiduous collector of medals and line engravings. Being interrogated as to the particular specimens of the numismatic or chalcographic art of which he was the fortunate possessor, he simply replied that the medals he meant were guineas, and the engravings Bank of England notes; and that, in his opinion, a man who collected anything else was a fool. Now, this extremely rich and miserly man was wise only in his generation. Everybody knows that wealth is an admirable thing to collect, and that a sum of money put out at five per cent. compound interest will double itself in the course of fourteen years. To this the collector of what Mrs. Ramsbotham or her congeners call "articles of bigotry and articles of virtue"—the collector who has only skill, taste, patience, and moderate means to pit against the tremendous puissance of money-bags—may reply that the acquisition of "curios" is often a much more remunerative investment than any of the ordinary channels by which rich men seek to make themselves richer. High interest, they may plead, means bad security. Bubbles which have floated very far aloft indeed, and have borne a brilliantly auriferous appearance, have ignominiously collapsed ere now, and have been found to consist of only so much attenuated soapsuds. There are speculations which turn up the very reverse of trumps, and petroleum wells of which the excavators do not by any means "strike ile." Finally, Black Fridays may occur, bills may be returned, and banks may break. On the other hand, such is the contention of the collectors, a bit of old Japanese, or Dresden, or Sèvres picked up by chance thirty years ago for a few shillings may fetch to-morrow at Christie's a hundred and fifty pounds. The old book collector may remind the millionaire that, entirely setting aside the exceptionally "fancy" prices which "Valdarfer" Boccaccios, and "Vinegar" and "Breeches" Bibles command, a copy of the first edition of Ruskin's "Modern Painters" is now worth ten times the price at which it was originally published; and that in degree there has been a corresponding enhancement of money value in the case of such works as first editions of Dickens and Thackery, Owen Jones's "Grammar of Ornament," Hamerton's "Etching and Etchers," and Lane's "Arabian Nights." To invest in works the price of which has risen so largely above their normal rate can scarcely be called a speculation, since it is humanly certain that these books will become scarcer, and consequently dearer, every year. And, again, they enjoy, practically, a complete immunity from forgery. The very cleverest American reproduction of Ruskin or Owen Jones would not deceive a bibliophile; whereas it is quite possible for the very sharpest of pictorial experts to be imposed upon by a sham Titian or a spurious Gainsborough.

There happens to be one department of "virtù" in which collectors have been lately somewhat reluctant to invest, owing to certain embarrassing revelations made public through the vigilance of the officials of the Goldsmiths' Company. That department is old plate. An enthusiastic amateur of this very fascinating ware had "plunged" so deeply in purchasing antique silver that for a time the demand exceeded the supply, and, there being a deficiency of Charles II. and Queen Anne "vaisselle," it occurred to certain unscrupulous dealers to foist on the market a quantity of so-called old plate, the hall-marks on which had been impudently forged. Then came the notable case of the ingenious silversmith who employed a workman to cut genuine hall-marks out of small pieces, such as salt cellars and cream jugs, and insert the cuttings in large pieces of plate. The career of the shopkeeper who had promoted this clever system of manipulation, laudable for its adroitness, but scarcely defensible on ethical grounds, was cut short by an interview with a judge and jury, with the result of a term of imprisonment of no slight duration; and, for a considerable period following the ingenious shopkeeper's conviction, collectors of ancient plate were rather chary of resorting to any but long-established dealers of reputation wholly above suspicion, or of purchasing at auctions any plate that did not possess a positively unimpeachable pedigree. To judge, however, from the prices realised at a sale of old family silver and silver-plate which recently took place at Messrs. Debenham and Storr's, the antique silver market has recovered its tone, the unpleasant escapades of the past have been forgotten, confidence has been restored, and lovers of old plate are once more enabled to follow, undismayed, their beloved pursuit of collecting. The competition at Messrs. Debenham's was, it is stated, most active, and the sums at which the various lots were adjudged to the highest bidders afford matter for much curious reflection. For example, a "fine old two-handled stirrup-cup and cover," weighing a little less than 66 ounces, went for £124 17s. 6d., being at the rate of 38s. an ounce. The intrinsic value of this stirrup-cup is £16 10s., but the "fashion" is doubtless very fine; or perhaps the rare old tankard has a history of its own, and may have belonged to some personage famous in English history. Who, for example, would not give a "fancy" price for Oliver Cromwell's "black jack," or beaker, of thick leather, hooped with silver, which is in the collection of a well-known connoisseur of old plate? As it was, a "black jack," mounted with silver, was knocked down for twenty guineas at the sale under notice. A pair of urn-shaped vases of silver-gilt, adorned with classic bas-reliefs, designed by Flaxman, for Rundell and Bridge, weighing 334 ounces, fetched only £220, less than 20s. an ounce. The amateurs were quite right in not bidding more. Flaxman's flag does not cover the whole cargo in this case. When Josiah Wedgewood, as a potter, is combined with John Flaxman, as a designer, the result is simply supreme; but Rundell and Bridge, deservedly eminent as they were as a firm of jewellers and silversmiths—from them was hired the crown for the coronation of George IV.—flourished at a period when the art of the "aurifaber" in England was at a very low ebb indeed. The Continent had long been closed to us through the war with France; and the bulk of our gold and silver ware was as hideous as our furniture, our paper-hangings, and our carpets. Another item in the sale at Debenham's were two "ancient ecclesiastical patins," weighing 15 ounces, which brought a little less than 20s. an ounce.

The silver products of Rundell and Bridge were again at a comparative discount in the case of a lot described as "a silver-gilt cake basket, with ram's-head handles—a beautiful specimen of art workmanship." This cake basket, weighing 82 ounces, was knocked down at the low price of £63 10s. Once more the amateurs may have known thoroughly well what they were about. Perhaps the cake basket, albeit beautiful in design, was not so beautiful a specimen of workmanship. The greater part of the plate of the Rundell and Bridge period is certainly the reverse of brilliant, but the circumstance of its "fashion" being "classical" does not in any way prove the existence of a reaction against classicism on the part of the connoisseurs, since French plate of the First Empire, coldly classical as it is in design, is in constantly increasing demand, owing to the admirable efficiency of its art-workmanship. An antique silver waiter of George I., weighing 24 ounces, fetched £29; and a silver waiter of William III., dated 1698, weighing less than 10 ounces, was adjudicated at £15 3s. 6d. It should be worth every penny of the money which it brought, and more. Just as we owe the excellence of our Charles II. silver to the close intercourse of England and France during the reign of the Merry Monarch—an intercourse which enabled the English goldsmiths to study the works of the famous Jean Berain, the "orfèvre" in ordinary to Louis XIV., so should William III.'s silver ware be extremely precious to English collectors, from the fact that the Protestant champion brought with him from Holland a certain Huguenot artificer by the name of Marot. This excellent designer, whose works have been described as "an inexhaustible treasury of models for gold and silver," had been originally the architect of William of Orange, and his early architectural pursuits probably led to his designing those candlesticks in the form of Corinthian columns to which the name of "Queen Anne's" are popularly given. Marot died in 1702, but he was undeniably the exemplar of the splendid silversmiths of the Queen Anne period. The silversmiths of that Augustan age were likewise materially aided in their advances towards excellence by the number of celebrated French engravers who came over to England to execute the plates for the great national work illustrative of "the Wars of Marlborough;" an artistic enterprise projected, oddly enough, by the Frenchman Dubosc. Nearly all these engravers were likewise designers for gold and silversmiths, and many had been, like William Hogarth, engravers of silver plate, and even chasers thereof. No Queen Anne's ware seems to have been brought forward at this notable sale in Covent Garden: but a George III. "small antique coffee urn," weighing a little over 40 ounces, was sold for £43. An Elizabethan chalice and cover, dated and hall-marked 1573, weighing less than nine ounces, sold within a shilling of eighteen guineas, say 40s. an ounce, a very reasonable price, as were, indeed, most of the prices realised. Genuine antique plate is an exceedingly scarce and precious commodity, and must be paid for in proportion to its beauty and its rarity.—*Daily Telegraph.*

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 122.)

Alessandro Leopardi, who was working at Venice previous to 1487, was more important as a bronzist, and to his rendering of Verrochio's design we owe the grandest equestrian statue in the world. Recent investigation would seem to show that the more important portion of this work is due to Leopardi, and that the figure of Bartolomeo Coleoni was entirely modelled by his hand, which completed the horse left unfinished at Verrocchio's death, and also designed and executed the admirable vase. Frequent and careful examination, and an intimate knowledge of the bronze works by Verrocchio, would lead the writer to agree in the main with Mr. Perkins' observations on this noble group. Leopardi has affixed his name, inscribed on the saddle-girth—"A. Leopardi Ppvs. V.F." It was completed in March, 1496. Nothing can exceed the power and vigour of this group; the horse is admirably modelled, and the attitude of the rider, nerved to the combat, is strikingly characteristic of the defiant warrior. The details, carefully executed, are very beautiful. So delighted were the Signory at Leopardi's success, that they commissioned him to make the great bronze sockets for sustaining the standard masts in the piazzo before St. Marco, on the central one of which is introduced an excellent medallion portrait of the doge, Leonardo Loredano. There is a copy of this socket, which is dated 1505, in electro-deposit, in the South Kensington Museum (No. 63,—2.—3).

A new era in the life of art seemed to be created by the magic touch of Michel Angelo. Sculpture and her sisters earnestly striving to embody the sentiment they would convey in more expressive and intelligible forms of beauty, had already attained to high perfection in manipulative skill and plastic power, in which, nevertheless, the earnest motive for culture became dormant, and its life-inspiring sentiment faded into mere fashion. The religion of art was again dead, and she became the handmaid of observances and the Church's splendour, of inconographic self-glorification, of eye service, and the vanities or pride of life.

We must confine ourselves to the drier details of our subject. Michel Angelo executed nothing that remains to us in bronze. Condivi and Vasari, seemingly in error, tell us he made a bronze *relievo* of the Virgin and Child, which was sold to a Flemish merchant named Moscron; but there is little doubt that they refer to the admirable group in marble still at Bruges, and over the altar beneath which Pierre Moscron lies buried. In 1502, he was ordered to make another statue of David in bronze for the Maréchal de Gié, which was eventually completed by Benedetto da Rovezzano in 1508, and sent to France. It is no longer known to exist.

Michel Angelo's great work in this material was the colossal seated statue of Pope Julius II., which was set up over the great door of St. Petronio's Vasilica at Bologna in 1508, where it remained only till 1511, when a fickle populace, stimulated by the French troops who had entered the city in aid of the Bentivoglio cause, hurled the statue down and broke it into fragments; these afterwards were used by Alfonso, of Ferrara, to form a cannon named by him his "Julius."

Angelo preferred working in marble. In his conversation with the Pope on the subject of this statue, Michael Angelo told him "that bronze casting neither is, nor has been, my profession," and "that I could not guarantee success." "Cast it until it does succeed," was the reply; but Angelo states, "I was obliged to cast it twice;" and, again, "As half the metal did not melt, the figure was only completed to the waist; wherefore, I was obliged, before re-casting it, to pull the furnace to pieces." After relating his trouble and expense in the matter, Angelo writes: "But enough! Having, with great trouble, at last set the statue up in its place, I found that my two years' labour had profited me four ducats and a half."

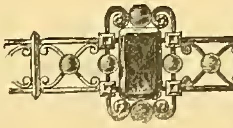
In the Louvre is a fine bronze figure of Apollo with the Python, in Angelo's manner, and certainly of his school.

Guglielmo della Porta, of a Lombard family, adopted Angelo's manner after entering the service of Paul III. in 1547, whose monument was his finest work. It is surmounted by the seated effigy of that Pope, a grand figure in bronze, while round the base were placed four recumbent allegorical figures, of great power but dubious meaning, in marble.

Two of these are yet on the altered monument in St. Peter's; the others are in the Palazzo Farnese. A small bronze recumbent female figure, with two children—perhaps representing Latona—is in the writer's collection, and probably is a carefully-studied model by the hands of this able artist. One Tomaso della Porta (but not a member of the same family), cast the bronze statues of SS. Peter and Paul, which surmount the Trojan and Antonine columns at Rome. He died in 1618. Daniele Ricciarelli da Volterra (1509—1566) modelled and cast in bronze the portrait head of Michel Angelo, probably that now preserved in the halls of the Conservatori at the Capitol, and which has been wrongly ascribed to Angelo's own hand.

Leo Lioni, of a Comese family, although known as "II. Cavaliere Aretino," worked much in bronze. His portrait medal of M. Angelo, taken from life, is referred to by Vasari. He worked also for Charles V., for whom he made a portrait statue in bronze, which is now at Buon Retiro. Lioni also was Director of the Mint at Milan. Pompeo Lioni, his son, followed without improving his father's manner. Antonio Fontano (1540—1587), an able metal worker and bronzist, in the rococo style, cast the rich bronze gates for the cancellum of the Church of S. Celso, at Milan. To this artist, or to Annibale Fontana, are ascribed the fine bronze candelabra in the Certosa at Pavia. Francesco Brambilla, Jacopo, and Tomaso Casignuola, Simon of Pavia, and Giovanni Simone di Germano ought also to be mentioned.

(*To be continued.*)



TECHNICAL EDUCATION.

GOLDSMITHS' HALL, LONDON.

1882.—ELEVENTH COMPETITION.

With a view to the encouragement of Technical Education in the Design and Execution of Works in the Precious Metals, the Goldsmiths' Company of London have settled the following Programme of Prizes for the current year:—

£70. A Prize of £70 for the best Model in Plaster, or other suitable material, finished, ready for casting, of a group "Man with Two Coursing Greyhounds," the extreme height of the man not to exceed fourteen inches.

£35. A Prize of £35 for the second best Model.

£70. A Prize of £70 for the best Model in Plaster, or other suitable material, finisbed, ready for casting, of a Ewer and Disb, subject to be taken from Coleridge's "Ancient Mariner," the cost of which, when manufactured, would not exceed £250.

£35. A Prize of £35 for the second best Model.

£35. A Prize of £35 for the best Specimen executed in Repoussé Work in Silver, of a Relief of Two Men and Horses from the West Frieze, Elgin Marbles, 82ª, a Copy of which may be procured by intending Competitors, at Goldsmiths' Hall, upon payment of the sum of £1, which sum will be returned to every actual Competitor at the close of the Competition. The subject to be of the size of eight inches by seven inches. Imperfections from decay to be restored.

£20. A Prize of £20 for the second best Specimen.

£25. A Prize of £25 for a Silver Cup, six inches in height, with Ornamental Chasing from a Design, a photograph of which may be obtained by intending Competitors at Goldsmiths' Hall.

£15. A Prize of £15 for the second best Specimen.

£20. A Prize of £20 for the best Design of a flat Fruit Dish, all Silver, not to exceed four inches in height, the cost of which, when manufactured, would not exceed £30.

£10. A Prize of £10 for the second best Design.

£25. A Prize of £25 for the best Design of a Centre-piece for Flowers only, the height not to exceed six inches, and the cost of which, when manufactured, would not exceed £100.

£15. A Prize of £15 for the scond best Design.

£15. A Prize of £15 for the best Design of a Salad Bowl, the cost of which, when manufactured, would not exceed £50.

£10. A Prize of £10 for the second best Design.

£15. A Prize of £15 for the best Design of a Claret Jug, the cost of which, when manufactured, would not exceed £25.

£10. A Prize of £10 for the second best Design.

£15. A Prize of £15 for the lightest and soundest specimen of Core Casting in Silver (the Jets to be cut off, and the seams from the Mould to be absolutely untouched), combined with fineness of the seams, of a Statuette of "Mercury," a copy of which may be procured by intending Competitors at Goldsmiths' Hall upon payment of Five Shillings, which sum will be returned to every actual Competitor at the close of the Competition.

£10. A Prize of £10 for the soundest and best Specimen of Flat Casting in Silver, in Alto-Relief, combined with lightness and fineness of the seams, of a Medallion of Charles IX. of France, a copy of which may be procured by intending Competitors at Goldsmiths' Hall upon payment of the sum of Two Shillings and Sixpence, which sum will be returned to every actual Competitor at the close of the Competition.

£25. A Prize of £25 for the best Specimen of Engraving of the Figures of "Venus and Harmony," by Flaxman, the Figure of Venus to be seven inches in height, a photograph of which may be obtained by intending Competitors at Goldsmiths' Hall.

£10. A Prize of £10 for the second best Specimen.

£15. A Prize of £15 for the best Specimen of Engraving of an oblong Box in Silver, length four inches, a photograph of which may be obtained by intending Competitors at Goldsmiths' Hall.

£10. A Prize of £10 for the second best Specimen.

The cost of the manufactured articles is not intended to include the expense of Designs, of Moderns, Patterns, or Dies.

Everything offered for Competition must have been made within the present year, and by a British subject, and the prizes will only be given to the actual executants.

All Designs must be drawn, and all Models made, to exact size.

Any partial gilding must be shown on each Design or Model.

An indication must be given on each drawing, showing which parts are to be hammered, which chased, and which cast and chased.

Originality shall be necessary to obtain either of the Prizes for Design, and no copy shall be the subject of a Prize.

The Prizes will be awarded in the month of December next, and Objects of Art and Workmanship must be sent by the Competitors to Goldsmiths' Hall, addressed to the care of the Clerk, in the week ending the 25th of November, between the hours of 11 a.m. and 4 o'clock p.m.

Each object shall have a Word or Motto attached to it, a counterpart of such Word or Motto being put on the outside of a sealed envelope addressed to the Clerk, and containing within it the name and address of the Competitor, which Envelope will not be opened until the Prizes shall have been awarded, and any object shall be excluded from a Prize if any indication be given of the Competitor.

Competitors for two or more Prizes must put the same Word or Motto upon every Design and Object sent in for Competition, and they must state distinctly in each case for what Prize they are competing.

The objects sent in Competition for Prizes shall be left until the 1st of March for exhibition by the Goldsmiths' Company, if the Company shall think proper to cause them to be exhibited.

Competitors may, if they please, mention a price for which they are willing to sell the Design or Object exhibited, and the Copyright therein.

The Company reserve to themselves the right to withhold the Prizes for the several objects before-mentioned, or either of them, if they shall be of opinion that no object of sufficient merit shall have been submitted to them.

The Company have also resolved that a Travelling Scholarship of £100 may be awarded by the Wardens to a Student who has shown exceptional talent, and who shall have obtained Prizes for Design or Modelling in three years' Competitions, in order to enable him to study Art in the precious metals on the Continent of Europe.

GOLDSMITH'S HALL, *January*, 1882. WALTER PRIDEAUX, *Clerk of the Goldsmiths' Company.*

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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TWO ILLUSTRATED SUPPLEMENTS:—1. Designs for Modern Jewellery. 2. Antique Rings and Ornaments.

No. 83.—Vol. VII.] APRIL 5, 1882. [Subscription, 5s. per Annum. Post Free.

The Future of the English Watch Trade.

By James U. Poole.

(*Continued from page* 118.)

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—At the conclusion of my last paper I intimated that retailers had considerable power over the future of the English watch trade, and will now proceed to enter into the fuller discussion of the subject.

I have already committed myself to a definite expression of opinion respecting the relations of manufacturers and retailers, in a paper published in this Journal for July, 1880; but I was then more especially referring to first-class London houses who are firmly established on their own merits, and the majority of them are fully sustaining the reputation of English work, although there are several conspicuous exceptions whom it is not necessary to designate by name. In order that a trade or manufacture may flourish, it is desirable that there should be no hostility between the various branches of it, and the watch trade is especially dependent upon the energy and enterprise of those who come to the front and place themselves in the most advantageous positions and localities for bringing the productions of manufacturers within the reach of the public. I have always maintained that it takes two people to sell a watch, as it is very rare that the actual manufacturer is possessed of that business tact which is requisite in dealing with customers having very little or no knowledge of the merits of the articles they are solicited to purchase. At the same time, there is an increasing tendency on the part of buyers, in all departments of trade, to put themselves in direct communication with manufacturers. As I have before intimated, this idea has been very much fostered by the various International Exhibitions which are held from time to time, a principal condition in the awards being that the real manufacturers among the exhibitors shall have the preference. The Clockmakers' Company, in the prizes which they annually offer for the two best chronometers at the Greenwich trial, recognise this principle to the utmost, for their regulations are framed to prevent any but the actual makers of instruments from obtaining them. The American Watch Company also owe their success to the position they occupy of being *bona fide* manufacturers, selling the productions of their own factory, and by this means they have made room for themselves in an already crowded market. I would here like to observe that the latest figures at my disposal, namely, those published by Mr. Rigg last year, do not convey the impression that the quality of the watches sold in this country at present is of a very high order. It would appear that 24,330 *uncased* movements were imported in 1880, of an aggregate value of £40,000, being an average of less than 33s. each. This would show that it is the Coventry manufacturers who are most affected by their competition, as was, indeed, evinced in the interest taken by the manufacturers of that town, in the Parliamentary Committee appointed to inquire into the laws relating to Hall-marking in 1878-9. I have recently been interviewed by a Coventry manufacturer who stated, as an inducement for business, that he had all his cases marked in London, and also that his best customers were Clerkenwell "manufacturers," thus proving beyond a doubt that low-priced watches cannot at the present time be made in this locality. At the same time, I am struck by the reflection that this wholesale and indiscriminate use of the London trade-mark has the effect of making many believe that the goods were actually made here, thereby favouring the chances of success of a *bona fide* manufacturing undertaking. Certain it is that at the present time the eyes of the world are upon us, expecting us to do something, and I, personally, have been rather roughly handled by certain critics, who seem to throw the onus on me of leading the way. Thus, at the conclusion of my lecture at the Horological Institute, two years ago, the following remarks are reported in the Journal as having been made by Mr. Denman, who for years has had the benefit of being associated with my friend, Mr. Kullberg: "At the conclusion of the lecture Mr. Denman said he had hoped that Mr. Poole would have indicated some improved system of manufacture. The trade suffered, among other things, from the lack of good machine tools suitable for facilitating rapid production. In his opinion the going barrel made a better low-priced watch than the fusee." I fully admit that I gave that lecture on strictly conservative lines, which I hope I shall continue to hold as regards best work; and I also desired to draw forth the opinions of others instead of forcing them.

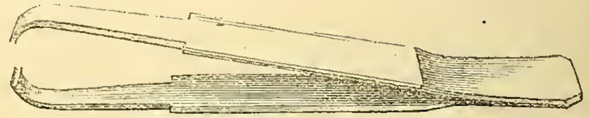
In a leading article which appeared in due course in the *Clerkenwell Press*, the writer asks: "Are manufacturers of the present time to accept Mr. Poole's dictum that English watches must continue to be produced under the now existing system? If so, we are afraid the watch trade of England will gradually decrease under the combined competition of Switzerland, France, and America. * * * We would urge our countrymen to adopt the good portions of the Swiss and American systems, and to modify and improve them as far as practicable, that work may be produced in this country as quickly and cheaply as in the countries already named. One of the worst and most expensive factors in English manufacturing is the sad want of uniformity, and until that is overcome we are afraid little progress will be made in increasing, or rather reinstating, English wares in the markets of the world." Then, again, I have been urged, in your pages, by the energetic representatives of the American Watch Company, to visit their factory in America, in order that, like Favre-Perret, I may have my eyes opened to what is going on, and return as a leader in the trade, to urge my countrymen to the necessity of making similar efforts.

I have ventured, sir, to refer to the foregoing criticisms and advice in order that your increasing circle of readers may be aware that I am not pursuing the topic merely as a pastime, but because of the general interest that undoubtedly attaches to it. The American Watch Company have said that it would help them for an English undertaking to succeed, and in the same manner I may say that they will prove very useful auxiliaries during the period of its formation, because they are familiarising the public with watches of a certain construction, and also educating workmen to work on their system. I have always been prejudiced against the idea of a watch factory, for when I came into the trade as a lad, nearly thirty years ago, the failure of the British Watch Company was a current topic; but surrounding circumstances are now entirely different. Then, workmen who entered its employment were tabooed—or, as we now say, "boycotted;" and as there was a plentiful supply of labour, and no lack of business, masters were able to enforce such measures; but those days are gone, never to return, to the same extent. Now, not only the employers are for the most part elderly men, but the workmen also; and there will always be a sufficient demand for the best work to employ the few that are left. It is to be regretted that their talents are not better appreciated by some retailers, who, by their prominence, have excellent opportunities of disposing of their work; and I cannot refrain from quoting a passage from the *Daily Telegraph* of the 23rd ult., referring to the deterioration in the shipbuilding trade, which runs as follows:—"The same fierce competition that covers our tables with butter made of fat, and coffee made out of old beans, is covering the ocean with the sort of ships I am writing of. * * *The shipbuilders are not to blame.* They will do good work for good money; but if good money be not forthcoming, though some kind of work be expected, then they will give you frames which are only fit to sell for old iron; the workmanship will be mere 'clagging;' the plates will be wrenched and warped into any kind of abominable fit by the rivets, and the false and frail contrivance, doctored up and smothered over with paint, will be launched with all haste *that the account may be settled* and the next order proceeded with at once." Years ago, the founders of many of our retail businesses took as much pride in selling genuine, first-class work as the manufacturers and workmen who were employed on it; but now, the totals of the sale-sheets are taken into primary consideration, and, in the meantime, the industry is gradually dying out. The question is now, whether a National Watch Factory can be established in or near London; and, as general publicity is the only means by which any scheme can be carried out, I would suggest that it would be advantageous, as a preliminary measure, for a lecture to be delivered at the Society of Arts, followed by a discussion.

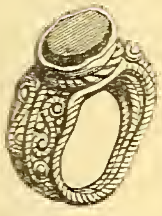
It is certainly a question of paramount importance that our highest mechanical art should be prevented from leaving us.

(*To be continued*).

Watch-Hand Tweezers.—If you ask what is the most frequent cause of a watch stopping and going irregularly, I think I should answer—imperfection in the handwork. If a watchmaker was to show me a specimen watch that he had made or repaired, the first thing I should examine would be the way he had placed the hour, minute, and seconds hands, and from these I should be able to form a tolerably correct judgment of his ability as a workman. The conditions necessary for correct working are so simple, and so well understood, that it is unnecessary to mention them; but one of the most difficult matters, and frequent cause of trouble, is in removing the hands from a watch that are tightly fitted. The accompanying sketch shows a pair of tweezers, admirably adapted for taking off tightly-fitted hands without danger of of bending, breaking, or losing them. They can be purchased at any tool shop for 1s.—R.W.



ANTIQUE RINGS AND ORNAMENTS.



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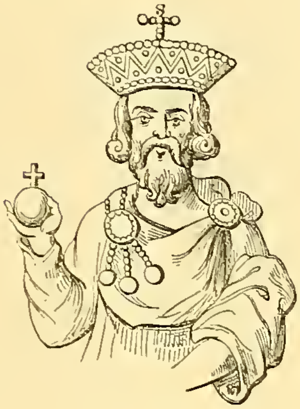

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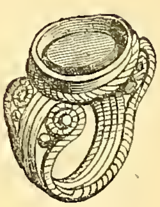

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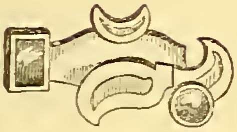

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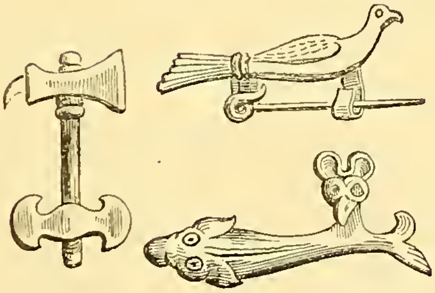

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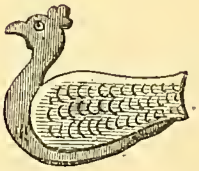

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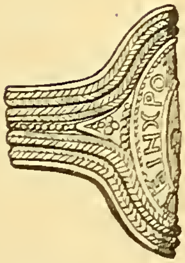

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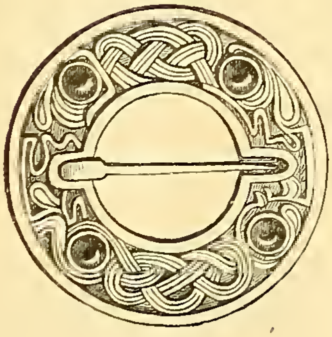

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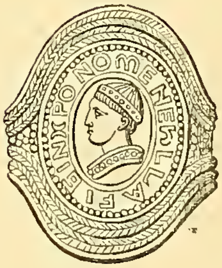
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43.

For Description see page 147.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

(*Continued from page* 137.)

XXXV.

Resists and Reserves.—By reserves, certain parts of a metallic article which may be already covered with an electro-deposit on its whole surface, are coated with another metal. To gild the parts in relief of an object of which the body is silvered, make a gold reserve, and use a silver reserve for silvering of certain parts of a body already gilt. This requires a little practice and care, and a firm hand to make thin lines with the hair pencil. Thoroughly scratch-brush and wipe the object; the parts intended to have the primitive colour must be covered by a brush with a resist varnish; dry in the air, or in a stove, or upon a gentle fire until it no longer feels sticky. Place in the bath; the galvanic deposit will only coat those parts unprotected by the varnish. The temperature of the bath should be low, and the current weak, for fear of having rough lines where the deposit touches the varnish from the latter becoming softened, or from bubbles which are disengaged at the negative pole under the action of a strong electric current. When the deposit is completed, remove the resist varnish with warm essence of turpentine, and afterwards with tepid alcohol; gaseine or benzole are preferable, as they rapidly dissolve in the cold, nearly all resinous and fatty bodies, or the varnish may be destroyed by a brief immersion in concentrated sulphuric acid when cold. It often happens that several colours and metals have to be placed upon the same object, such as silver with both a bright and a dead lustre, and yellow, green, red, white, or pink golds, or platinum. Varnishes are also employed for avoiding the deposit of the precious metals upon those parts which do not need them.

Resist or Reserve Varnishes.—Dissolve in boiled linseed oil or essence of turpentine, resin, or copal; these varnishes are not sufficiently coloured to distinguish the places where they have been laid on; mix with them, therefore, a certain proportion of red lead, chrome yellow, or Prussian blue, which at the same time facilitates their drying.

Old Silver.—To imitate old artistic productions made of solid silver, the ground work and hollow portions not subject to friction are covered with a blackish red earthy coat, the parts in relief remain with a bright lead lustre. Mix a thin paste of finely-powdered plumbago with essence of turpentine, to which a small proportion of red ochre may be added to imitate the copper tinge of certain old silver ware; smear this all over the articles. After drying, gently rub with a soft brush, and the reliefs are set off by cleaning with a rag dipped in spirits of wine. Old silver is easily removed and the brightness of the metal restored by a hot solution of caustic potash, cyanide of potassium, or benzole. To give the old silver tinge to small articles, such as buttons and rings, throw them into the above paste; rub in a bag with a large quantity of dry fir-wood sawdust until the desired shade is obtained.

Oxidized Silver.—This is not an oxidization, but a combination with sulphur or chlorine. Sulphur, soluble sulphides, and hydro-sulphuric acid blacken silver, and insoluble silver salts, and particularly the chloride of silver, rapidly blackens by solar light. Add four or five thousandths of hydro-sulphate of ammonia, or of quinti-sulphide of potassium, to ordinary water at a temperature of 160° to 180° Fahr. When the articles are dipped into this solution an iridescent coating of silver sulphide covers them, which, after a few seconds more in the liquid, turns blue-black. Remove, rinse, scratch-brush, and burnish when desired. Use the solution when freshly prepared, or the prolonged heat will precipitate too much sulphur, and the deposit will be wanting in adherence; besides, the oxidization obtained in freshly-prepared liquors is always brighter and blacker than produced in old solutions, which is dull and grey. If the coat of silver is too thin, and the liquor too strong, the alkaline sulphide dissolves the silver, and the underlying metal appears. In this case cleanse and silver again, and use a weaker blackening solution. Oxidized parts and gilding may be put upon the same articles by the following method. After the whole surface has been gilt, certain portions are covered with the resist varnish; silver the remainder. Should the process of silvering by paste and cold rubbing be employed, the gilding should be very pale, because it is not preserved, and is deeply reddened by the sulphur liquor. When this inconvenience occurs from a too concentrated liquor, it is partly remedied by rapidly washing the article in a tepid solution of cyanide of potassium. Deep black is thus obtained upon cleansed copper.—Dissolve 3 or 4 oz. of blue ashes, hydrocarbonate of copper, in a sufficient quantity of aqua ammonia, place the cleansed copper in this solution, cold or tepid, it will be instantaneously covered with a fine black deposit. This coat is so thin that burnished articles look like varnished black.

(*To be Continued.*)

Index to Antique Rings and Ornaments.

33 & 35—Two rings in the Londesborough collection, found, with other gold ornaments, near the remarkable tumulus, known as "New Grange," a few miles from Drogheda. The stone in both rings is a cut agate.

34—Bust of the Emperor Constantine Pogonatus, with his jewels and ornaments. Period 668 A.D. to 685.

36–40—Brooches found in Italy and Germany from the barbaric period which followed the downfall of the Roman Empire. The decline in good taste is most strikingly demonstrated by these specimens. They are all decorated with enamels of most unnatural colours.

41 & 43—Side and Front View of an Anglo-Saxon ring during the Heptarchy, found in a meadow at Bossington, near Stockbridge. The whole is of gold, and of considerable weight and thickness. The gold threads are all beautifully reeded, and the lettering and head executed with great care. The inscription reads:—"NOMEN EHLLA FID IN XPO," (My name is Ella, my faith is in Christ.)

42—A ring fibula, of white metal, gilt, and set with four gems, closely resembling carbuncles. An irregular interlacing pattern is worked over the whole front surface, but it is perfectly plain behind. It was found at Stamford, in Lincolnshire, but is supposed to be of Scandinavian origin, probably the property of a Danish lady.

A key for turning the spring coil upon the balance is made as follows: A steel arbor, provided with a handle of suitable length, ends in a cone at its end, into which a hole is driven and provided with a wing, filed sharp below. The balance is placed upon the little table above spoken of. Place with the right hand the little instrument upon it in such a manner that the balance pivot enters the hole, and the little knife is inserted into the cut of the collet, which thus may easily be moved until the stud occupies its hole exactly.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

GOLD without alloy of silver, or containing a slight percentage of silver, is generally reported by the assayers in carat and carat grains above, *better*, or below, *worse*, the established standard of 22-carat for gold coin of the realm.

Fine gold, free of any admixture of silver or any other metal, is designated 24-carat. Each carat divides into four grains, and the grain into eighths of a grain, or thirty-seconds of a carat.

If the report is, for example, *better*, 1 c. ⅝ gr., it has to be added to the standard of 22-carat, which will denote the metal as 23 c. ⅝ gr.; and if the report is *worse*, 2 c. 1⅝ gr., it has to be subtracted from the standard of 22-carat, which will realise 19 c. 2⅜ gr.

Some assayers report in the more rational way of millions or thousandths parts of fine gold in the metal. The following table will give the equivalents of millions in carats, and the value of the various divisions per. ounce.

The inferior metal (copper) is not computed in the calculation of value of bullion, but may be recovered, if desired, or may be utilized by standarding the metal.

EXAMPLES OF CALCULATIONS.

Better, 1 c. 3¼ gr., add to 22 c.
23 c. 3¼ gr.

c.	gr.			£	s.	d.	
23	0	value	..	4	1	5½	per oz.
0	3	,,	..	0	2	7½	,,
0	0¼	,,	..	0	0	2½	,,
23	3¼	value	..	4	4	3½	per oz.

Worse, 3 c. 2⅝ gr. deduct from 22 c.
18 c. 1⅜ gr.

c.	gr.			£	s.	d.	
18	0	value	..	3	3	9	per oz.
0	1	,,	..	0	0	10½	,,
0	0⅜	,,	..	0	0	4	,,
18	1⅜	,,	..	3	4	11½	per oz.

Fineness in Carats.		Milliemes.		Value per oz. £	s.	d.
24	=	1000	.. ..	4	5	0
23	=	·958	.. ..	4	1	5½
22	=	·917	Standard	3	17	11
21	=	·875	.. ..	3	14	4½
20	=	·833	.. ..	3	10	10
19	=	·792	.. ..	3	7	3½
18	=	·750	.. ..	3	3	9
17	=	·708	.. ..	3	0	2
16	=	·667	.. ..	2	16	8
15	=	·625	.. ..	2	13	1½
14	=	·583	.. ..	2	9	7
13	=	·542	.. ..	2	6	0½
12	=	·500	.. ..	2	2	6
11	=	·458	.. ..	1	18	11½
10	=	·417	.. ..	1	15	5
9	=	·375	.. ..	1	11	10½
8	=	·333	.. ..	1	8	4
7	=	·292	.. ..	1	4	9½
6	=	·250	.. ..	1	1	3
5	=	·208	.. ..	0	17	8½
4	=	·167	.. ..	0	14	2
3	=	·125	.. ..	0	10	7½
2	=	·083	.. ..	0	7	1
1	=	·042	.. ..	0	3	6½

To find the value of dwts. above full ounces in the alloy, divide the value of an ounce by 20 for every dwt , and for grains divide the value of a dwt. by 24 for every grain, or divide by the respective decimals.

Fineness in Carats.		Milliemes.		Value per oz s.	d.
3⅞	=	·010	.. .. ..	3	5
3¾	=	·039	.. .. ..	3	3½
3⅝	=	·038	.. .. ..	3	2
3½	=	·036	.. .. ..	3	0¾
3⅜	=	·035	.. .. ..	2	11½
3¼	=	·034	.. .. ..	2	10
3⅛	=	·033	.. .. ..	2	8¾
3	=	·031	.. .. ..	2	7½
2⅞	=	·030	.. .. ..	2	6¼
2¾	=	·029	.. .. ..	2	5
2⅝	=	·027	.. .. ..	2	3½
2½	=	·026	.. .. ..	2	2¼
2⅜	=	·025	.. .. ..	2	1
2¼	=	·023	.. .. ..	1	11½
2⅛	=	·022	.. .. ..	1	10¼
2	=	·021	.. .. ..	1	9
1⅞	=	·020	.. .. ..	1	7¾
1¾	=	·018	.. .. ..	1	6½
1⅝	=	·017	.. .. ..	1	5
1½	=	·016	.. .. ..	1	3¾
1⅜	=	·014	.. .. ..	1	2½
1¼	=	·013	.. .. ..	1	1
1⅛	=	·012	.. .. ..	0	11¾
1	=	·010	.. .. ..	0	10½
⅞	=	·009	.. .. ..	0	9¼
¾	=	·008	.. .. ..	0	8
⅝	=	·007	.. .. ..	0	6½
½	=	·005	.. .. ..	0	5¼
¾	=	·004	.. .. ..	0	4
¼	=	·003	.. .. ..	0	2½
⅛	=	·001	.. .. ..	0	1¼

The parting-assay of a mixture containing gold, silver, and base metals is reported in ounces, dwts., and grains of fine gold and fine silver in the pound troy of 12 ounces. Some assayers report the fine gold and fine silver in milliemes.

The following tables will give the value of the metal in either report per ounce.

FINE GOLD

	Value per oz. £	s.	d.
12 ounces in the pound	4	5	0
11 ,, ,, ,,	3	17	11
10 ,, ,, ,,	3	10	10
9 ,, ,, ,,	3	3	9
8 ,, ,, ,,	2	16	8
7 ,, ,, ,,	2	9	7
6 ,, ,, ,,	2	2	6
5 ,, ,, ,,	1	15	5
4 ,, ,, ,,	1	8	4
3 ,, ,, ,,	1	1	3
2 ,, ,, ,,	0	14	2
1 ,, ,, ,,	0	7	1
19 dwt. ,, ,,	0	6	8¾
18 ,, ,, ,,	0	6	4½
17 ,, ,, ,,	0	6	0¼
16 ,, ,, ,,	0	5	8
15 ,, ,, ,,	0	5	3¾
14 ,, ,, ,,	0	4	11½
13 ,, ,, ,,	0	4	7¼

	Value per oz. s.	d.
12 dwt. in the pound ..	4	3
11 ,, ,, ,, ..	3	10¾
10 ,, ,, ,, ..	3	6½
9 ,, ,, ,, ..	3	2¼
8 ,, ,, ,, ..	2	10
7 ,, ,, ,, ..	2	5¾
6 ,, ,, ,, ..	2	1½
5 ,, ,, ,, ..	1	9¼
4 ,, ,, ,, ..	1	5
3 ,, ,, ,, ..	1	0¾
2 ,, ,, ,, ..	0	8½
1 ,, ,, ,, ..	0	4¼
21 grains ,, ,, ..	0	3½
18 ,, ,, ,, ..	0	3
15 ,, ,, ,, ..	0	2½
12 ,, ,, ,, ..	0	2
9 ,, ,, ,, ..	0	1½
6 ,, ,, ,, ..	0	1
3 ,, ,, ,, ..	0	0½

To find the value of dwts. above full ounces in the alloy, divide the value of an ounce by 20 for every dwt.. and for grains divide the value of a dwt. by 24 for every grain, or divide by the respective decimals.

FINE SILVER.

	Value per oz. s.	d.
12 ounces in the pound ..	5	0
11 ,, ,, ,, ..	4	7
10 ,, ,, ,, ..	4	2
9 ,, ,, ,, ..	3	9
8 ,, ,, ,, ..	3	4
7 ,, ,, ,, ..	2	11
6 ,, ,, ,, ..	2	6
5 ,, ,, ,, ..	2	1
4 ,, ,, ,, ..	1	8
3 ,, ,, ,, ..	1	3
2 ,, ,, ,, ..	0	10
1 ,, ,, ,, ..	0	5
19 dwt. ,, ,, ..	0	4¾
18 ,, ,, ,, ..	0	4½
17 ,, ,, ,, ..	0	4¼
16 ,, ,, ,, ..	0	4

	Value per oz. s.	d.
15 dwt. in the pound ..	0	3¾
14 ,, ,, ,, ..	0	3½
13 ,, ,, ,, ..	0	3¼
12 ,, ,, ,, ..	0	3
11 ,, ,, ,, ..	0	2¾
10 ,, ,, ,, ..	0	2½
9 ,, ,, ,, ..	0	2¼
8 ,, ,, ,, ..	0	2
7 ,, ,, ,, ..	0	1¾
6 ,, ,, ,, ..	0	1½
5 ,, ,, ,, ..	0	1¼
4 ,, ,, ,, ..	0	1
3 ,, ,, ,, ..	0	0¾
2 ,, ,, ,, ..	0	0½
1 ,, ,, ,, ..	0	0¼
½ ,, ,, ,, ..	0	0⅛

To find the value of dwts. above full ounces in the alloy, divide the value of au ounce by 20 for every dwt.

VALUE IN MILLIEMES PER OUNCE.

PARTS OF FINE GOLD IN METAL.

	£	s.	d.			s.	d.
1·000	4	5	0	·050	..	4	3
·900	3	16	6	·040	..	3	5
·800	3	8	0	·030	..	2	6
·700	2	19	6	·020	..	1	8
·600	2	11	0	·010	..	0	10
·500	2	2	6	·009	..	0	9
·400	1	14	0	·008	..	0	8
·300	1	5	6	·007	..	0	7
·200	0	17	0	·006	..	0	6
·100	0	8	6	·005	..	0	5
·090	0	7	8	·004	..	0	4
·080	0	6	10	·003	..	0	3
·070	0	5	11	·002	..	0	2
·060	0	5	1	·001	..	0	1

Standard, ·917.

PARTS OF FINE SILVER IN METAL.

		s.	d.			s.	d.
1·000	..	5	0	·050	..	0	3
·900	..	4	6	·040	..	0	2¼
·800	..	4	0	·030	..	0	1½
·700	..	3	6	·020	..	0	1
·600	..	3	0	·010	..	0	0½
·500	..	2	6	·009	..	0	0½
·400	..	2	0	·008	..	0	0⅜
·300	..	1	6	·007	..	0	0⅜
·200	..	1	0	·006	..	0	0⅜
·100	..	0	6	·005	..	0	0¼
·090	..	0	5½	·004	..	0	0¼
·080	..	0	4¾	·003	..	0	0⅛
·070	..	0	4	·002	..	0	0⅛
·060	..	0	3½	·001	..	0	0⅛

Standard, ·925.

Silver is also reported with regard to standard of 11 oz. 2 dwts. of fine silver in the pound troy established for silver coin of the realm. The pound is divided in 240 parts or dwts. of fine silver, which leaves for the standard 222.

The report is given *better* or *worse* in accordance with the parts of fine silver contained in the alloy. The smallest division in the report for silver is ½ dwt. in the pound, as the following examples will show:—

Better 2½ dwt., signifying 11 oz. 5½ dwt., or 227½ parts or dwts. of fine silver in the pound troy.
Worse 7½ dwt., signifying 10 or 14½ dwt., or 214½ parts or dwts. of fine silver in the pound troy.

The following table gives the value of the alloy per ounce:

		Value per oz.	
		s.	d.
240	dwts. of fine silver in the pound	5	0
230	,, ,, ,, ,, ...	4	9½
222	,, Standard ,, ,, ...	4	7½
220	,, of fine silver ,, ...	4	7
210	,, ,, ,, ,, ...	4	4½
200	,, ,, ,, ,, ...	4	2
190	,, ,, ,, ,, ...	3	11½
180	,, ,, ,, ,, ...	3	9
170	,, ,, ,, ,, ...	3	6½
160	,, ,, ,, ,, ...	3	4
150	,, ,, ,, ,, ...	3	1½
140	,, ,, ,, ,, ...	2	11
130	,, ,, ,, ,, ...	2	8½
120	,, ,, ,, ,, ...	2	6
110	,, ,, ,, ,, ...	2	3½
100	,, ,, ,, ,, ...	2	1
90	,, ,, ,, ,, ...	1	10½
80	,, ,, ,, ,, ...	1	8
70	,, ,, ,, ,, ...	1	5½
60	,, ,, ,, ,, ...	1	3
50	,, ,, ,, ,, ...	1	0½
40	,, ,, ,, ,, ...	0	10
30	,, ,, ,, ,, ...	0	7½
20	,, ,, ,, ,, ...	0	5
19	,, ,, ,, ,, ...	0	4¾
18	,, ,, ,, ,, ...	0	4½
17	,, ,, ,, ,, ...	0	4¼
16	,, ,, ,, ,, ...	0	4
15	,, ,, ,, ,, ...	0	3¾
14	,, ,, ,, ,, ...	0	3½
13	,, ,, ,, ,, ...	0	3¼
12	,, ,, ,, ,, ...	0	3
11	,, ,, ,, ,, ...	0	2¾
10	,, ,, ,, ,, ...	0	2½
9	,, ,, ,, ,, ...	0	2¼
8	,, ,, ,, ,, ...	0	2
7	,, ,, ,, ,, ...	0	1¾
6	,, ,, ,, ,, ...	0	1½
5	,, ,, ,, ,, ...	0	1¼
4	,, ,, ,, ,, ...	0	1
3	,, ,, ,, ,, ...	0	0¾
2	,, ,, ,, ,, ...	0	.0½
1	,, ,, ,, ,, ...	0	0¼
½	,, ,, ,, ,, ...	0	0⅛

The bulk of the alloy of silver, of whatever quality, may also be brought to standard by adding fine silver if *worse*, or reduced to standard by adding copper if *better*, in accordance with the report, by following either of the following rules in examples:

In 148 oz. of silver, 12 dwts. *worse*, to find the quantity of standard.

Gross weight 148
Multiplied by the report 12
Divide by stand. 222)1776(8 oz.
1776
Deduct the result of 8 oz. from the gross weight of 148 oz.
Answer—140 oz. standard.

Standard 222
Deduct the report .. 12
Difference 210
Mltpld. by gross weight 148
Divide by stand. 222)31,080(140 oz.
Answer—140 oz. standard.

If in this question the report had been 12 dwt. *better* instead of *worse*, the result would have been *added* to the gross weight in the first example, making 156 oz. standard, or would have been *added* to the standard in the second example, making 234 to be multiplied by the gross weight. The difference of 8 oz. in the gross weight above the weight of standard contained therein may be utilised for converting the gross weight into the same weight of standard by adding, for every 1½ dwt. of the alloy in excess, 18½ dwt. of fine silver, to bring the bulk up to standard of 11 oz. 2 dwt. in the pound troy; and, in case the report had been for *better*, then for every 18½ dwt. of fine silver in excess of standard, 1½ dwt. of copper must be added to reduce the bulk to standard. The proportion for small quantities of silver to be standarded is 3 grs. to every 37 grs.

The standarding of two bars of silver, the one reported *better* and the other *worse*, may be effected by the following rule:—

Convert the reports into dwts. fine in the pound, and place in the following position:—

Report.	dwt. fine.		Answer.
Better 8 dwt.	= 230	Standard	14 parts of 230 dwt. fine.
Worse 14 dwt.	= 208	222	3 ,, 208 ,, ,,

Deduct the equivalent of dwt. in the report *worse* from standard, and place on the top in a line with report *better*; then deduct the standard from the equivalent of dwt. in the report *better*, and place below in a line with report *worse*, which will indicate how many parts of each bar to take to compose a mass of standard silver.

Analogous to the standarding of silver from two different assays, can a desired mixture of gold be effected from different qualities of gold-alloys, viz.: It is desired to alloy 15-carat gold, for which there is 17¾-carat and 9½-carat to be employed, which, computed by a similar method:

17¾ } 15 { 5½ parts of the 17¾-carat.
9½ } 15 { 2¾ ,, ,, 9½ ,,

When there is an ½ dwt. in the report, then double the report in numbers, and multiply with the gross weight, the product to be divided by a doubled standard, and the result to be deducted from the gross weight, as:

In 600 oz. of silver reported 18½ dwt. worse, what quantity of standard?

The report of 18½ doubled 37
Multiplied with the gross weight .. 600
Divided by a doubled standard 444)22,200(50
22,200
Result of 50 deducted from the gross weight of 600 oz., leaves 550 oz. standard;

or, take from the standard the report and double the difference, multiply with the gross weight, and divide by a doubled standard, viz:

From the standard 222
Take the report 18
Differenee 203½
Doubled 407
Multiplied with the gross weight .. 600
Divided by a doubled standard 444)244,200(550 oz. standard.
244,200

But when the report partakes of ounces and dwts., make the ounces to dwts. and add the additional dwts., and proceed the same way as examples *without* ½ dwts., viz.:

In 148 oz. of silver reported 1 oz. 4 dwt. worse, what quantity of standard?

Gross weight 148
Multiplied with 1oz. 4dwt. = 24
Divided by standard 222)3,552(16
3,552
Take from the gross weight 148
The result of 16
Leaves as standard .. .. 132oz.

OR

Take from standard .. 222
The report of 1 oz. 4dwt. = 24
Difference 198
Mltpld. with gross weight 148
Divide by standard 222)29,304(132
29,304
Leaves as standard 132 oz.

When the quantity of silver to be standarded contains dwts. above full ounces, treat the ounces separately without the dwts., and add for every dwt. reported *better* ½ grain of copper to every surplus dwt. of silver; and for every dwt.

reported *worse*, $1\frac{1}{3}$ grain of fine silver to every surplus dwt. of silver to be standarded, viz.:

Surplus 13 dwt., reported 12 dwt. BETTER.		Surplus 13 dwts., reported 12 dwt. WORSE.	
Report	12	Report	12
Multiplied with ..	$^{1}/_{9}$	Multiplied with	$1^{1}/_{3}$
Product	$1^{1}/_{3}$	Product	16
Muliplied with surplus	13	Mltpld. wth srpls.	13
	17 grs. copper.	Divided by	24)208 gr. (8 dwt. 16 gr. [fine silver.

In order to effect a correct standarding of a mass of silver after an assay report, it is of the utmost importance that every mass of bullion be uniformly mixed before assaying and at re-alloying, otherwise it cannot be expected that there should be no disagreement between the silversmith who sends his work made of the standarded silver to be Hall-marked, and the Assay Office to pass it. Yet, notwithstanding these precautions, a slight difference will occasionally happen, which is proved by the variations in the reports of different assayers of the quality of the same bullion submitted to be assayed. These variations may be accounted for either to some different modes in the process adopted in the manipulation of the assay, or the changing temperature of the furnaces used for assaying; and in order to meet these slight variations, a maximum remedy of 2 dwts. in the pound troy, or eight milliēmes ($\frac{8}{1000}$ part) in the ounce of excess alloy is allowed.

The value of silver is affected by fluctuations in the market. The approximate proportion of value of silver to gold is about 1 to 18, in accordance with the present value of 4s. 3d. for sterling silver, to £3 17s. 11d. for standard gold; or 4s. 8d. for fine silver, to £4 5s. 0d. for fine gold, per ounce.

Petition of the Council of the East India Association for the Abolition of the Duty on Gold and Silver Plate.

To the Right Hon. The Marquis of Hartington, M.P., P.C.,
Her Majesty's Secretary of State for India.

The humble Memorial of the Council of the East India Association

Most respectfully Showeth:

That the manufacture and chasing of gold and silver utensils and ornaments is one of the ancient art industries of India. It is still practised at Trichinopoly and other parts of the Madras Presidency, at Kutch, and in other parts of Western India; also at Delhi and Agra. In Kushuin the art exists, and its products are, or might be, largely exported from India; but the expansion of these artistic industries in India is virtually prohibited by the heavy Customs' duty that is levied in this country on gold and silver plate, other than filigree and jewel work. Although these Indian articles, wrought in these precious metals, are often brought to this country by private purchasers, who are willing to pay the high duty for their own gratification, that duty effectually prevents any mercantile business being conducted in these articles, and there is, therefore, no inducement for the natives of India to extend that valuable and remunerative industry.

That the attention of the Association has recently been directed to the impolicy of the laws relating to the manufacture and sale of gold and silver plate in the United Kingdom, and to the fiscal and other impediments to art progress prevailing in those trades.

That the attention of the Association has also been specially directed to the fact that, by the law of compulsory hall-marking, the importation of Indian and other foreign gold and silver manufactures (other than jewellery) is virtually prohibited inasmuch as, although such manufactures can be brought into the United Kingdom upon payment of the Customs' duty of 17s. per ounce gold, and 1s. 6d. per ounce silver, they cannot legally be exposed for sale unless hall-marked at one of the various assay offices—a process which, as it involves "the scrape and parting assay," damages the articles in such a way as to render a return to the workshop absolutely necessary, and in many instances, when the workmanship is of an elaborate character, injures them past hope of recovery.

That the duties upon gold and silver plate were unanimously condemned by the Select Committee on Hall-marking (1879), who recommended that they should be abolished (both Customs and Excise) as soon as the state of the revenue should permit.

That the same Committee, by a majority of only one, approved of the principle of compulsory hall-marking; but that, voting in the minority for perfect freedom of trade in the precious metals, are to be found the names of Mr. Goschen, Mr. Leonard Courtney, Mr. Thomson Hankey, and the late Mr. Whitwell.

That the Committee, although approving of the principle of compulsory hall-marking, recommended a thorough reform of the laws; and the President of the Board of Trade has already indicated the desire of Her Majesty's Government to proceed with such reform as soon as the state of public business may permit.

That, before any Bill for a reform of the hall-marking laws can be submitted to Parliament, it is obviously necessary that the trades should be free from taxation, inasmuch as it cannot be denied that the present practice of compulsory hall-marking is a sure and certain protection to the revenue, and that it would be impolitic in the highest degree to alter the law until the duties shall have been abolished.

That it is of the utmost importance to the social progress of India that greater variety of industries shall be encouraged; but the existence of the English import duty of more than 20 per cent. on gold plate and 33 per cent. on silver articles tends to destroy all chance of prosperity amongst the Indian craftsmen who work in the precious metals.

That, in the opinion of this Association, it is most desirable that the duties upon gold and silver plate should be abolished in April next, so as to pave the way for the Board of Trade to deal with the subject of hall-marking in the Session of 1883.

Your Memorialists therefore humbly pray that her Majesty's Secretary of State for India may, in the interests especially of Indian manufactures, use his influence with the Chancellor of the Exchequer in order to obtain the abolition of the duties upon gold and silver plate in the forthcoming session of Parliament.

And your Memorialists will ever pray, &c.

For the Council of the East India Association,

Patrick P. Gordon.
James Long.
O. C. Mullick.
C. W. Arathoon.
Wm. Martin Wood.

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(Continued from page 87.)

"Facts not opinions."

THE part of a going-barrel watch that I propose to examine in this paper is that which is known in the trade as bottom-supported and unsupported barrel-arbors. The latter are sometimes called suspended arbors.

This is a subject upon which horologists entertain widely-different views; and when opinions upon a question greatly vary, nothing can be more certain than that some must grossly err. I shall endeavour to show what are the facts of the case, regardless of the opinions concerning it; and in order to simplify and put into reading made easy a matter that is confessedly difficult, I think it will be best to examine it from an experimental point of view. An attempt has here been made to define and enlarge upon the word experiment, which was found inconvenient; the reader is, therefore, referred to page 155.

The short motto, "Facts not opinions," that is placed as a beacon at the head of this paper, has been taken from over the door of Mr. Kirkaldy's testing and experimenting works in Southwark Street, a place, it may be interesting to state, where a great variety of materials, especially engineering and building materials, are submitted to certain tests or experiments in order to ascertain their exact strength and safe-working pressure, so that they may not be submitted to any purpose beyond the ascertained capacity. I have here seen large bars and plates of iron and steel pulled asunder, and, at the same time, by means of a veneer and steel-yard, their exact elongation and power of resistance is recorded, revealing, in some instances, prodigious strength, and in others, where you would least suspect it, an amount of rottenness almost incredible. Here not only bricks and stones, but even pieces of iron and steel, may be reduced to powder by enormous pressure. It was in this establishment where parts of the memorable Tay Bridge were examined; and had the facts that were made known concerning it been previously understood, we should have been saved from one of the foulest blots in the engineering history of our time. In such a place this motto is most appropriate; but we must be careful to avoid extremes, and not unduly press this motto, or we may wrest its true meaning. The difference between a fact and an opinion is similar to the difference between probable evidence and demonstrative evidence. Those who have studied Butler's Analogy will not need to be told that *"probable evidence is essentially distinguished from demonstrative by this, that it admits of degrees, and of every variety of them, from the highest moral certainty to the very lowest presumption."* The scepticism that pretends to reject opinions and probable evidence, and insists upon having facts and demonstration as the only ground of assent, will soon be cured by considering that every step in life—the smallest transaction in business—the shortest journey—or the least morsel of food, can be taken only upon probable evidence or opinion; and though we may be as sure of the results as we are of the ebb and flow of the tide, yet we must wait for them. Shall I not liken the great volume of facts to the mass of hidden treasure that lies deeply buried beneath the surface of the earth, and therefore difficult of access? whereas, opinions are like the coin of the realm—always acceptable, easily negotiable, but should be received with caution, seing there is base metal in circulation; and it should form no small part of our business to discover those facts that rectify opinions, which are the very guide of life.

The first experiment we will make is a very simple one. Take an ordinary sprung-under full-plate fusee movement see that the hole for the barrel-arbor in the pillar is wide, and that the ratchet is small, and loosely and badly fitted; put the watch together, wind up the main-spring, and carefully note the arc of vibration. Then remove the name-bar, and notice the exact position of the barrel-arbor, and the difference in the arc of vibration. I have found the following result:—The barrel-arbor will lean slightly in the direction of the fusee; the edge of the barrel will touch the plate, and reduce the power; and the arc of vibration will be slightly diminished.

The second experiment may be made upon a movement similar to the first; but instead of the barrel-arbor fitting loosely in the pillar-plate, let the barrel-arbor hole be opened in the mandril perfectly upright, and, though it turns easily, it is without side-shake. Instead of the ratchet being thin and small, see that it is thick and large enough to come into close proximity to the teeth of the hour-wheel; and, above all, be careful to have it well fitted to the square of the barrel-arbor. Put the watch together, see that the ratchet is close to the plate, wind up the mainspring, note the arc of vibration, then remove the name-bar, and the following will be the result:—The loss of the name-bar will not alter the upright of the arbor, and the vibration will not be in any way affected.

From this most crude way of suspending the arbor we are led to inquire into the direction of the force of the mainspring and the amount of lateral pressure upon the barrel pivots, which is clearly shown by the following experiment:—Take an ordinary going-barrel; if the pivot-holes are wide, it will be an advantage; grasp the square tightly with the brass-nosed sliding tongues, grasping the barrel firmly between the finger and thumb; wind up the main-spring with your right hand. It will at once be seen that the force is at a tangent with the pitch circle of the teeth of the barrel, and that the amount of lateral pressure upon the pivots is nominal. Further, it will be seen that as you increase the tension of the spring, the amount of side pressure upon the pivot is also increased, and if the pivots of the barrel-arbour are large—say three-fourths of the size of the arbour—the friction will be increased, and perceptibly improve the adjustment of the main-spring.

The fourth experiment—and for this I will provide the model, which may be seen by all interested at the office of this journal—shows a barrel-arbor attached or suspended to a pillar-plate that is capable of resisting at least one hundred times more side pressure than is necessary in a fourteen-size lever watch.

From these experiments I assert, first, that it is possible to attach a barrel-arbor to a pillar-plate that is capable of enduring all the pressure that is required; second, that a suspended arbor offers the great advantage of increasing the height of the main-spring without increasing the thickness of the watch, and it is, therefore, wise to adopt it where a moderately-thin watch is required; third, that the invention of a suspended arbor (doubtless due to the combined labours of Berthoud and the elder Breguet) has played a most conspicuous part in the history of watch-making. It can count its witnesses by millions, and its claims have a right to be patiently heard.

RICHARD WHITTAKER.

(To be continued.)

Lectures on Watch and Clock Making.

Preparatory for the Elementary Examination of the City and Guilds of London Institute in May, 1881.

Delivered at St. Thomas Charterhouse School by I. Herrmann on Monday Evenings, from October 25th.*

(Continued from p. 139).

GEOMETRICAL CONDITIONS OF LEVER AND ROLLER IMPULSE ACTION.

We have seen, that in the pallet action, there is nothing in common between them that limits the motion of the pallet during locking; hence a secondary adjustment is necessary, which is the banking or banking pins. These banking pins effect both the position of the pallets in relation to the periphery of the escape-wheel and that of the lever in relation to the ruby pin and length of fork. It is evidently necessary that the side of the fork remains in contact with the ruby pin, while the escape-wheel tooth is on the impulse plane. But if the lever is arrested by the banking immediately the tooth has escaped, both sides of the lever notch being of equal length and the pin round, the ruby pin cannot pass out of it. As in the lever the impulse is imparted in both directions, and, assuming it is carried to the same angle on each side, each side propels the pin alternately, and, therefore, they must be of the same length. Therefore, we can only obtain freedom for the ruby pin for exit out of the notch, by giving it additional angular motion after the impulse or drop of the wheel, which is called technically, "run."

The necessity of "run" evidently is proportioned to the form of the pin. If we have a ruby pin flattened to its diameter, we do not alter the conditions, but diminish the necessity of the magnitude of the angle of "run."

Let Fig. 66 show this fact. ∠ a R L is $\frac{1}{2}$ the impulse angle of the roller = $\frac{1}{2}$ 40° and ∠ a L R $\frac{1}{2}$ the impulse angle of the lever = $\frac{1}{2}$ 10°. Assuming that the lever is arrested by banking pin d immediately the tooth has dropped, it will be seen, that with a round pin we should require a further angular motion of the lever for the pin to pass out of the notch, and become detached, but with the same pin flattened we get the necessary freedom without it.

We have shown, that the unlocking action is similar to the impulse action of the horizontal, but the pallet energy required to overcome the resistance of the potential energy of the escape-wheel is supplied by the balance. Hence, as it is evident, that we require the balance motions maintained with the least amount of impulse power, and that impulse power being represented by the algebraic sum of moment and resistance, it follows that the moment must be proportioned to the loss by resistance, and that extra "run" implies extra resistance to the balance in unlocking, and therefore in a good escapement we have an impulse pin which projects as little in excess of its impulse radius as possible. It may be stated here, that a very small angle of run is necessary to ensure the free escape of each tooth.

RATIO OF LEVER AND ROLLER IMPULSE RADII AND PALLET IMPULSE ANGLE.

The average magnitude of pallet impulse angle is 10°. It is a matter which depends greatly on the quality of the work. If a pallet with an impulse angle of 7½° has much side play on its pivots, then the ruby pin becomes the centre of motion when the impulse should commence, and hence greater part of the moment would be lost. Though a large impulse angle gives less moment, as we have shown, nevertheless it will neutralize the evil of bad fitting holes; hence pallets with small impulse angles should always have jewelled holes, and brass pallet holes require larger impulse angles. This appears so self-evident, that separate diagrams are not necessary to prove it.

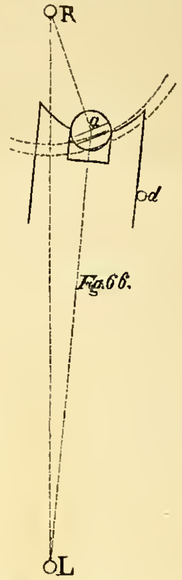

Fig. 66.

With a given lever and balance impulse angle, their radii are approximately inversely as their angles;* this gives the ratios sufficiently near for practical purpose, and hence we have the exact condition of the duplex pallet and impulse radius of wheel. The student must not confound the geometrical condition with the impulse moments in the two actions. Hence it will apply here what we have shown in relation to Fig. 58. The centres of motion of that figure being identical with pallet and balance centre and the point of intersection, would represent the centre of the ruby pin; the position of the centre not being altered, though it may be reduced to its diameter.

The ratio of impulse angle and radii is further influenced by the condition which distinguishes between impulse angle, and angle of impulse contact, which we pointed out in the horizontal escapement.

The object of the locking, as we shall notice further in connection with the guard action, is to hold the lever in its position of rest against the banking, during the detached vibration of the balance. Since, then, it is necessary that the tooth should arrest the pallet entering its periphery safely, it follows that this safety requires that the edge of the locking plane should have passed the periphery before the delivery edge of the corresponding pallet has passed out of it. That being the case, it is evident that the pallet cannot occupy the same angular position on its return motion, or where the impulse action commences, and where it ended. There is an angular difference, which is proportionate to the angular position of the locking edge when the opposite pallet becomes disengaged, or is proportionate to the depth. We will call this the angle of locking penetration.

Suppose there were no locking angle, then the angular impulse motion of the lever would be equal on each side of the line of centres; but assuming it as 1°, then it must

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* Really inversely as the sines of their angles.

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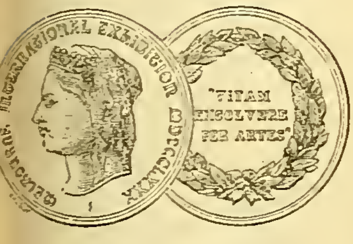
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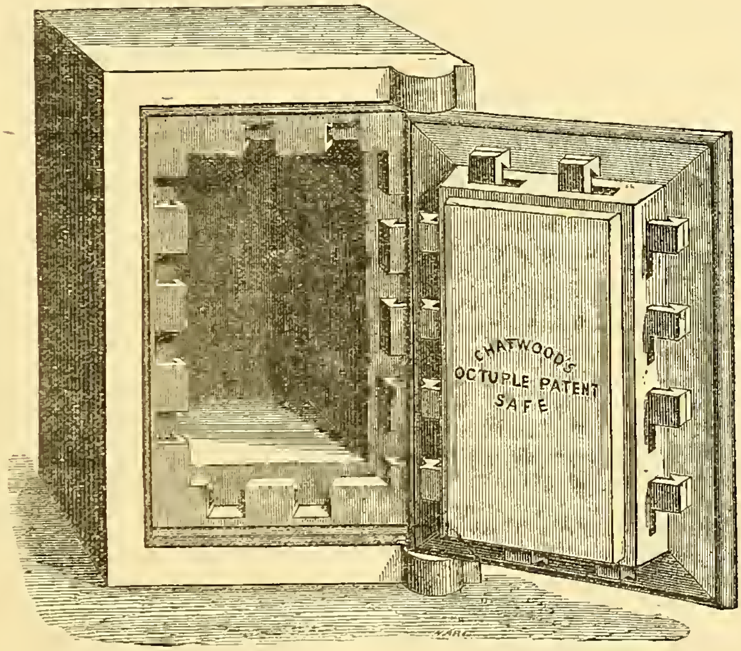
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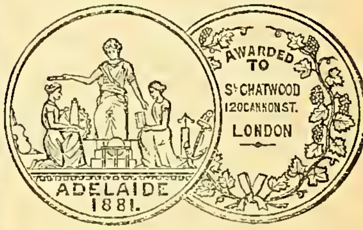
ADELAIDE
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DEGREES OF MERIT.

11,
CROSS STREET,
MANCHESTER.
WORKS: BOLTON.

CHATWOOD'S "INVINCIBLE" SAFES

HIGHEST AWARDS ALL EXHIBITIONS

GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST E.C.

ENGLISH *v.* FOREIGN MANUFACTURE.

So much has been heard lately about the improvement in workmanship abroad and of its deterioration here, that it is gratifying to find an instance where England has fully maintained her old pre-eminence. The Dutch papers just to hand contain reports of the trial of an English safe, which was brought about somewhat strangely. It appears that some time since there was at Arnhem an international exhibition under the authority of the Government of the Netherlands. Among the objects intended to be tested, and for which medals and rewards were offered, were safes. The conditions of competition were prepared by authority, and they stated that a safe was wanted that should be at once fire-proof, fall-proof, and burglar-proof. A gold medal and a money prize was offered to the most successful maker, and a silver medal and a smaller money prize to the second. Mr. Samuel Chatwood, the well-known English safe manufacturer, determined to compete for the prize, and made a safe to answer the conditions imposed. It happened, however, that the Netherlands Minister of Commerce asked him to assist on the jury; he was elected president, and that made competition on his part impossible. There were twelve competitors; nine of them were Dutch and three German. The first hour's fire over, the fall test followed, and two of the safes were utterly broken, and so placed *hors de combat*. The remaining ten went through the second fire test, and it was afterwards found that in each the papers inside were charred. Two workmen, with a set of ordinary burglar forcing tools, undertook the burglar's task, and opened all the ten safes in twelve hours. No safe withstood their attack for four hours, while one was opened in less than five minutes. There were complaints, and several of the safe-makers and others interested said openly that the conditions of trial were such that no safe could stand. On this Dr. Bosscha, the president of the international grand jury, asked Mr. Chatwood if he would consent to his safe being submitted to the same tests. He consented, and the trials took place on the 20th of December at Amsterdam.

The announcement caused considerable excitement among the safe-makers on the Continent. M. Van der Maden, the Director of the royal factory for the making of steam and other engines, found the space on which the trials were to take place. On Saturday morning, the 20th December, a goodly number of people assembled, and before the firing test began there were present many of the principal inhabitants of Amsterdam, including members of the Government, of the Town Council, of the Army and Navy, as well as of merchants and manufacturers. Almost all the safe-makers who competed at Arnhem were there to see how this English safe would bear itself under the conditions which led to their easy defeat. Four brick pillars were built on a circular brick base, and on these the safe was placed, the hauling being done by a powerful crane resting on huge shears. The safe was 5ft. high, 2ft. 7½in. wide, and 2ft. 2½in. deep; it weighed 2 tons. As soon as it stood in its place, several men heaped about it plenty of wood in large and small pieces, and then started the fire. Before it had burned ten minutes, the fuel reached to and lay on the top of the safe, and so intense was the heat that the hundreds of people about were forced to keep their distance, and a small fire engine was called into requisition to play on the shears and save them from combustion. After burning an hour the safe was lifted to the height of twenty feet and pulled over a stone-laid floor for the second or fall trial. This trial was more severe than was intended, for before the men were ready the slip-hook was accidentally released, and the safe came down with a tremendous thud on the stones, breaking and sinking them into the hard frozen ground. No effect of any kind was produced on the safe, and it was again subjected to fire for three hours longer. Here again the test was more severe than at Arnhem, for while there only eight cubic yards of wood were used as fuel, at Amsterdam twelve cubic yards were burned. There was much speculation as to the condition of the safe, most of the safe-makers present being convinced that the fire test had been too much for it.

On the Monday morning the interest seemed to have increased, as there was again a large assembly of people to see the lifting of the safe and the placing of it in a shed to be submitted to the burglar-proof test. The jury had invited the competitors of Arnhem to select two of the most skilled workmen they knew to undertake this, but they all declined, notwithstanding the fact that Mr. Chatwood offered a reward of 100 gulden to the workmen who succeeded in opening the safe. Under these circumstances M. Van der Maden found two, one of them having been a safe-maker for twelve years. They were complimented all round on the skill they displayed in finding points of attack. They had brought their own tools with them, and were permitted to use them or those which were used at Arnhem. They elected to use the latter set, weighing 56 lb. They set to work, but after two hours' hard labour gave up, saying they had broken all their chisels and bars. Mr. Chatwood then consented that they should use also the tools they themselves had brought, another weight of 56 lb. They set to again, but were just as much foiled. All the time they were at work some of the safe-makers stood close by, and were continually making suggestions.

This failure being complete, Mr. Chatwood resolved to try to open the safe, so as to get at the contents, by machinery next day. At five minutes to ten the next morning, after drawing the safe to its place under a powerful radial steam drilling machine, the men commenced to drill out the stud bolts of the door, under Mr. Chatwood's superintendence. The working drawings not being at hand, the exact position of these studs could not be told, which necessitated the drilling of three holes for one stud and two holes for another in the bottom of the door. During the time this drilling was going on the machine was running at its highest power. After this, at Mr. Chatwood's request, an attempt was made to drill out the lock. The attempt proved futile on account of the point of the drill coming into contact with the hard metal intersection between the lock and the outer door. After placing considerable power on the drill it was withdrawn. The point of the drill was found completely rounded off in the attempt to get through the hard metal. After all the studs were drilled out, and therefore the actual holding power of the door was gone, an attempt was made to prise open the outer door by means of sets and heavy sledges. This, however, proved completely unsuccessful. The safe was then turned on the side on which the hinges were, and two large holes drilled on this side by the radial drill. After this, by means of large steel drifts and a further application of the crowbars, the door was at length opened. This was not until about four o'clock, and many men had been employed. A change of hands for the hammers was employed throughout, about ten of the best men in the works being told off for the duty. The interior door was opened by its own keys after a delay of about twenty minutes, the delay being occasioned by the bolts having become rusted into their holes by the condensation of steam during the fire proof. On the door being opened the papers were found in every respect in as good condition as when put in the safe before the fire test.

The trials were under the special direction of Dr. J. Bosscha, Director of the Polytechnic School of Delft; Ph. Lindo, Director of the Cement Factory, Delft; H. A. Raveneck and J. G. Snijders, Professors of the Polytechnic School, Delft; H. L. Woltersom, Civil Engineer, Arnhem—these being the president, secretary, and members of the jury for the international concours held at Arnhem. These gentlemen have signed and issued an official report, in which they state that the safe stood each test perfectly; that all the documents in the safe were uninjured, writing and printing being exactly as when placed inside; and they further say—"On the strength of these trials, the undersigned judge that the requisites demanded in the Arnhem programme and tests for a safe constructed on proper principles have proved by no means too severe for the safe of Mr. Chatwood; nay, that in all probability Mr. Chatwood's safe would have stood a severer test for fire, falling, and burglary."—From the *Morning Post*, January 10, 1880.

be reduced before the line of centres, and increased past the line of centres.

That is with a driving angle of 10°, and ∠ of penetration 1°, the pallet angle of impulse contact = 10°, equal to $5\frac{1}{2}°$ on either side of the line of centres. But 11° is lost in unlocking. Therefore, the impulse angle before the line of centres = $5\frac{1}{2} - 1° = 4\frac{1}{2}°$, and the impulse angle past the line of centres = $11° - 5\frac{1}{2}° = 5\frac{1}{2}°$, and $5\frac{1}{2}° + 4\frac{1}{2}° = 10°$ = impulse angle. This fact has to be taken into account in relation to Fig. 68, in determining the impulse radii of lever and roller.

The ratio of joint magnitude of lever and roller to size of wheel and pallets depends again on the quality of the fittings, and the principle of inertia of matter given in Newton's "First Law of Motion" (p. 115, Vol. VI.)

It is evident that the same amount of freedom or clearance is sufficient and necessary, whether we have a large or small radii; but with a constant quantity we shall have much greater angular errors in small radii than large ones. Hence, again, short lever and roller radii require closer fittings, or are suitable only to best work.

But also when we increase the magnitude of lever and roller, we increase the mass, and, therefore, according to the first law of motion, the resistance is increased by its inertia. From this, then, we gather, that it is necessary to get rid of all superfluous mass in all sections of the moving parts of trains and escapements. This, of course, does not apply to the balance in the same sense.

BALANCE IMPULSE ANGLE.

This question of the magnitude of the balance impulse angle has a twofold bearing, viz., in regard to timing, which does not come within our present course (though we have pointed out the factors), and the mechanical provisions against stoppage in the escapement.

It is clear that the locking resistance is proportionate to the impulse force, or the circumferential force of the escape-wheel. Likewise, the rotary energy of the balance is proportioned to its mass and diameter, and, therefore, offers a proportionate resistance to the impulse. The question of time is one of dynamics, but the one of provision against stoppage is one of statics.

Now, suppose with a large balance angle of impulse and heavy balance, if at a point near the end of this arc the balance is arrested, we have equilibrio; that is, if the impulse moment and resistance of balance spring are balanced (the latter always being proportionate to magnitude of balance in a definite ratio), it follows that it would be possible for the watch to get into this condition and stop.

Now, clearly, we shall get rid of this fault if we make the impulse moment in excess of the balance resistance, which can be done by either diminishing the latter or increasing the former.

This would be done by a stronger main-spring, or smaller balance and weaker spring, or by reducing the impulse angle, which diminishes the resistance in the same ratio as it increases the moment.

Again, if the balance is arrested at a point where the unlocking is effected, and we have equilibrio, it also follows that the unlocking resistance is in excess of the elastic force of the balance spring; hence, we overcome this fault by diminishing the latter or increasing the former. This can be done by a weaker main-spring, or heavy balance and stronger balance spring; or, again, by increasing the impulse angle, so the locking is effected at a point where the elastic force of the spring is stronger.

Thus, in a lever escapement, in order that the watch should not stop, these ratios should be so adjusted that the watch can never be stopped, no matter what force arrests the balance; that is, whenever the cause is removed the watch starts off spontaneously without any external impulse or shakes.

In relation to unlocking we have to apply what has been said on the locking inclines, from which we gather that they should be only of such an angle as to ensure the safe rest of the lever against the banking. In the ordinary table roller action, which is the roller used in the escapement under consideration, 10° or 12° is sufficient, which will be more clearly seen when we show the method of construction.

THE GUARD ACTION.

Very little experience in the lever escapement will demonstrate the mechanical provision or auxiliary arrangement by which the motion of the lever across the line of centres, before the ruby pin is in the notch, is prevented, so that the pin will not come in contact with the back of the lever and make progress impossible. We need not here describe the arrangement, but only the conditions attached to it.

When the lever is resting against the banking there must necessarily be freedom between the guard-pin and the circumference of the roller. If, however, this freedom is so great as to admit such an angular play to the guard-pin that it allows the teeth to lose hold of the locking plane and pass on to the impulse plane, we obtain all the worst conditions we pointed out in connection with the roller contact in the duplex escapement.

A reference to what has been shown there will bring out this fact, that the decrease of the impulse arc is synonymous with an increase of the radius of the circumference of the roller, and, therefore, by the principle of the resolution of force which applies here in the same manner as in the roller action of last escapement, we learn that if the above error occurred the resistance to the roller would be in proportion to its magnitude, and according to the direction in which the roller is moving (see Fig. 55).

Since experience proves that a small balance angle of impulse is favourable to timing, and as in such a case the guard action becomes delicate, several modes have been devised, of which the double roller is one, by which arrangement the angle of contact, formed by the balance and lever radii, approximate to tangential contact.

(To be continued.)

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The name of "Stibéine" is, says *L'Art et l'Industrie*, given to an article which in its appearance recalls the article of caoutchouc, sold under the name of erasing rubber. It is composed of a mixture of caoutchouc and emery, ground into fine dust, moulded into tablets, and cut into convenient shapes. It removes the rust from steel or iron in the "twinkling of an eye."

Balance Spring Table.—A round plate of brass of about 22 mm. in diameter and 1 mm. in thickness, stands upon four small feet about 10 mm. high, flat on top, and provided with nine small holes for the reception as well as the cylinder as anchor and chronometer balance springs, and to offer facilities of turning them upon it. This little table is greatly preferable to the riveting tool commonly made use of for this purpose.

To speedily make ivory flexible, immerse it in a solution of phosphoric acid (specific weight 1·13) until it partly or entirely loses its opacity; then wash it in pure cold water and dry. In this condition it becomes as flexible as leather, but gradually hardens when exposed to dry air. An immersion in hot water also destroys its softness and flexibility. The following method also may be used: Lay the ivory in three ounces of nitric acid, diluted with 15 ounces of water. The ivory will be soft in three or four days.

The Construction of a Simple but Mechanically Perfect Watch.*

By M. Grossmann, *Watch Manufacturer, Glashuette (Saxony).*

(Continued from page 123.)

162. The movement of a keyless watch ought not to be charged with any extra friction of moving parts if it can be avoided. In some watches of this kind the motion-work has to carry with it one or two setting wheels, and sometimes a pinion, all of them adjusted in a way which does not reduce friction to its least amount. As soon as one of these stop-screws has been overlooked, when the repairer provides the movement with oil, the friction created by it will bring the watch to a standstill, especially when the sink for the screw's head fits rather closely. All these accessories ought to be brought into action only in the moment of setting the hands, and should recede afterwards and leave the motion-work entirely free. Care must be taken that the setting wheel acts in the direction to the centre of the minute wheel when pushed into gear. The teeth of this wheel, too, ought to be pointed and thin, so that its entering into gear causes no sudden displacement of the hands if the teeth of both wheels chance to meet with their points.

163. The form of the teeth of the winding wheels and pinions, as usually made, may be classified into two kinds; the one is the usual form of wheel teeth, and the other one, much in favour with the Swiss makers, has a ratchet-like tooth, both for the flat and angular gear. This latter form, if properly made, is by no means objectionable, since these wheels always act in but one direction, so that the shape of that side of the tooth not called into action is of no consequence, and the only consideration for it must be to give it the greatest possible degree of strength. The very thin wheels generally used in Swiss keyless watches fully justify this way of shaping the teeth, but then the natural character of the tooth ought to be an epicycloid on the acting side, with a hollow back just affording the necessary room for the tooth of the other wheel to pass freely. Most wheels of this kind, however, have so strangely-shaped teeth that they make the impression as though taste had a principal share in their construction. Winding wheels of proportionate thickness may, without fear of breakage, have the common shape of teeth. Certainly the teeth ought not to be too fine, and the flanks and bottom must offer the best conditions of strength; therefore, they must be short, and may be so, since they have only to lead through a very small angle, after which they are relieved in the gear by the next tooth. The sides ought to diverge slightly, this giving an increase of breadth to the lower part of the tooth, and the bottom ought to be hollow.

164. The size of teeth is, with the keyless mechanisms of the rocking bar category, essentially prescribed by the toothing of the motion work, and in consequence of it, most of these mechanisms have finer toothed wheels than desirable. A little extra wheel, concentrically adjusted upon the setting wheel, and of the same size teeth with the minute wheel, will relieve from all restriction, and enable the constructor to use teeth of the proper size. With the mechanisms of the other class, the size of the teeth is quite optional.

165. As a material for the winding parts, steel is generally used; and for the pinions no other known metal would prove suitable. With respect to the wheels, and especially the large ones, I always thought steel, when hardened, might not be sufficiently reliable, since nobody can know whether there is not a tendency to break in some part of it. For these reasons I made them of aluminium bronze for a time; but I had to give it up, not that they had given any reason of complaint, but only because customers seemed to prefer the look of steel wheels.

166. The casing of keyless movements requires some extra work as compared with that of key-winders. The fixing-pin, contrary to the general rule (90), must here be near the pendant, because if not, the movement could not be put in. In the keyless watches with the setting parts on the winding axis, I find it a good plan to have this axis removable, and have it secured by a bridge fixed at the end of the pillar plate. The inner pivot of the axis moves, as usual, in a brass stud rivetted into the pillar-plate.

The pinion and the setting cannon must have just the necessary freedom in the sinks made for them in the pillar-plate, so that they remain in their places when the axis is drawn out, lest they should make the reinsertion of the axis rather difficult.

This arrangement greatly facilitates the casing, and has also the additional advantage that the action of the winding pinion and contrate-wheel can be verified without the movement being in the case.

The winding-knob is fixed to the outer extremity of the axis in the common way, and the axis is held in its place by a screw going through one-half of the pendant, the inner end projecting into a notch turned into the axis. The head of the screw is sunk into the outside of the pendant.

With this disposition, a movement, after taking out the axis, can be taken out of the case and put into it with the same ease as a simple movement. For hunting watches, a little allowance must be made for a small motion of the axis in the direction of its length for the purpose of opening the front cover of the case. For effecting this the shutting-spring has a hole, through which the axis passes freely, while a shoulder of the same pushes the spring inward by a pressure on the knob.

167. The push-piece in many keyless watches projects from the periphery of the rim of the case. If such is the case, it ought to be adjusted in a way as to completely shut the opening in the case. A round pin with a head outside generally answers very well, and so does also a round disc of about half the thickness of the rim, and projecting a little less than half its surface (Fig. 36).

The projecting push-pieces, however, have been much objected to from several points of view. The first and most serious objection was, that any accidental pressure might push the motion-work into gear, and thus alter the position of hands or arrest their course. With the large-linked heavy chains worn now, it is not a rare occurrence that a part of the chain gets into the pocket, and by some chance presses against the push-piece. Another objection is the apprehension that dust may find its way through the opening for the push-piece. This is, however, of no great consequence, for a push-piece fitted in a careful and judicious way will not allow much dust to penetrate in. The projecting push-pieces have also been objected to on the ground of good taste, which will not suffer any unsymmetrical protuberance. This argument is not of great weight.

(To be Continued.)

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An alloy which has a fine appearance after colouring, is made as follows: For 18-carat, 18 gold, 3 silver, 3 copper 15-carat, 15 gold, 3 silver, 6 copper.

A spring may be laid flat and its temper drawn between two plates fastened together by a screw through the centre, and placed upon the annealing plate. A small piece of whitened steel is laid upon it, to enable the operator to judge of the degree of heat. Before opening, let it cool. When drawing the temper, lay the coils farther apart.

Trade Notes.

Mr. David Glasgow will have to answer for his injudicious and ungenerous attack on American Watches in a Court of Justice, the American Watch Company having entered an action for damages against him.

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Mr. Augustus Fridlander, of 26, Hylton Street, Birmingham, has removed the London Branch of his business from 52, Clerkenwell Road, to 103, Hatton Garden.

* * *

At the Bicycle and Tricycle Show held at Bingley Hall, Birmingham, under the patronage of the Speedwell Club, Messrs. Vaughton & Sons, Manufacturing Jewellers and Medallists, of Great Hampton Row, exhibited several cases of medals designed and finished with the style usual to this first-class firm, and, as may be expected, their exhibits were very much admired. Their Victoria Crosses with enamel figures in the centre, representing the various phases of athletics, commanded particular attention.

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As we announced in December, the Naval and Engineering Exhibition will be opened at the Agricultural Hall on Monday next, the 10th inst. The Chronometrical Art, according to the published List of Exhibitors, will only be represented by one firm—Messrs. James Poole & Co. Our esteemed correspondent, Mr. J. U. Poole, is responsible for the arrangement of the exhibits, which we doubt not will sustain the world-wide reputation this firm so justly enjoys.

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The London Chamber of Commerce purposes constituting a section specially to consider the interests of the Gold and Silver trades. This important body comprising representatives of the most influential City houses, cannot fail to have great weight with the Government whenever the question of the plate duties, hall-marking, &c., is again brought forward. In connection with this subject, we note with pleasure the nomination by Sir Sydney Waterlow, M.P., of Mr. Alfred Bedford, of the American Watch Company, for election to Membership of the Chamber. We hope this means that the experience and judgment of Mr. Bedford is considered of value, and will be availed of when the aforesaid section is constituted.

* * *

The Royal Commissioners appointed to inquire into the instruction of the industrial classes of foreign countries in technical and other subjects have issued their first report. The commissioners have come to the conclusion that the influence of the new laws enacted and proposed in France as to the diffusion of ordinary and superior primary instruction, both literary and technical, can scarcely be overrated. They commend the instruction in the use of tools during the elementary school age as tending to facilitate the learning of a trade, though it may not actually shorten the period of apprenticeship; and they would be glad to see this kind of instruction introduced into some of the elementary schools here. The commissioners, however, do not recommend the introduction of apprenticeship schools—not, at least, until they have had a more prolonged trial abroad. The gratuitous lectures on literature and science given in all large towns in France are described as very valuable, and the art teaching in that country is so carefully extended that the number of *boná fide* working men receiving practical instruction there is greater beyond comparison than it is with us.

Henry Cresswell, Tyndale-buildings, Canonbury, in the employ of Messrs. E. W. Oakes & Co. (Limited), smelters and bullion dealers, Sheffield and Clerkenwell, was charged with stealing, on the 9th ult., 150oz. of fine gold, value £650, the property of his employers, Great Sutton Street, Clerkenwell. Mr. Henry Holland Oakes, son of the prosecutor, said on Thursday, at noon, he saw the bullion safe in the chest at the office. It contained 150oz. of gold. At that time the prisoner had the key of the bullion chest. At one o'clock the accused went as usual to his dinner, and before he left to go, took the key of the chest to him in his room. The prisoner did not return to the office as he was expected to do after dinner. At 3.30 witness received a telegram from the firm at Sheffield, but he did not say what it referred to. He then went to the chest, which he found locked. He opened it and saw that the parcel of 150oz. of gold was missing.—The prisoner was remanded.

Experiments.

"Facts not opinions."

PRIMARILY, the word Experiment means a test or trial in order to discover something that is not clearly understood. It is an act or operation designed to discover some unknown truth, principle, or effect, or to establish it when discovered. Ask Nature a question, and she will answer you by experiment. It is the backbone of inductive science. Experiment and observation are the means by which we extend and confirm our knowledge of nature. The introduction of experiment distinguishes the modern method of investigating nature from that of ancient times and the middle ages. Through experiment the investigator becomes master of the phenomena he is studying. It enables him to arrive at a knowledge of the laws of nature, the properties and powers of bodies and their actions upon each other; and when, by this means, a great principle is laid bare, progress and prosperity immediately follow. The more we sap science and mother earth, the richer we become. Our theories are best modified, corrected, and taught by experiment.

In conducting experiments, be careful to observe the most rigid economy. It very frequently happens that the preliminary trials of important inventions may be made in a very short space of time, and at a nominal cost. Suppose, for example, you are an experimental model maker, and that an inventor, inebriated with a new idea, asks with an emphasis, likely enough to cause you to mistake him for a seraph, "Can the weight of rolling coin be taken as it passes over a track occupying half a second in transit? I am inventing a machine for detecting and rejecting light gold and spurious coin." This question may be answered in a few minutes. Take a piece of strong note-paper; make the track he describes; cement it at the required angle with sealing-wax to the end of a beam, which may be made of a thin piece of firewood. The knife-edge pivots of the beam may be made of two common pins, and the weight of lead shot fixed in the lid of a pill-box. Fix it to a table, and with this toy-like affair you may determine the question as surely as if you occupied six months in making one of the most costly material and the best of skilled labours.

Some part of the first models of George Stephenson's locomotive were made of clay, and in the Library of the Royal Society there is preserved under a glass shade the first model of Sir Isaac Newton's telescope, which I suppose has done more to revolutionise and establish the opinions of learned men than any other model in the world. Nevertheless, the tube is made of cardboard, covered with marble paper, evidently the cover of a copy-book, and though the wooden stem and support on which it stands are neatly turned, yet they bear unmistakeabe proofs that they are the work of an amateur. And I suppose the exterior, for I have not been able to examine the interior, of this most interesting relic could be made for five shillings.

The reception of new truth through the medium experiment, is one of the most exalted pleasures that our natures are capable of. But while they are often alluring, not unfrequently do they proclaim how utterly at variance are our thoughts with the laws of nature, and sometimes when our imagination has taken its highest flight, and we bring our conceptions before the tribunal experiment, we fall only to flutter in the dust. Perhaps this may account for the fact, that successful inventors are blessed with more modesty than falls to the lot of most men.

It is therefore most important only to undertake such experimental work that you can prosecute to a successful issue. If, by experiment, you are shown to be in error, or on the wrong track, the same experiment points you to the high road to success. It may be a difficult and wearisome task, but success is certain. It is this patient continuance in successful experiment that has made Michael Faraday a prince among men; and if for this ennobling study, further commendation is required, it will be necessary only to add the eloquent and oft-repeated sentence—"Experiment is the solid foundation upon which rests the sublime philosophy of Newton."

RICHARD WHITTAKER.

A List of Watches, Watch Movements, Clocks, &c.

The Property of the Worshipful Clockmakers' Company, and Deposited in the Guildhall, London.

(Continued from page 127.)

Gough, William, London.

94. Silver Watch, silver dial (outer case wanting), No. 475. There is a peculiarity about the pendant-work of this watch, which is supposed to be for a maintaining power while the watch is being wound up.

Presented by B. L. Vulliamy, 1816.

Goullons, Paris.

95. A very curious small Gold Watch, the case enamelled in various colours, the design being raised in the Arabesque style (horsehair), prior to the introduction of chains; hour-hand only; ornamental enamelled dial. A very beautiful specimen of the art of enamelling.

Purchased by the Company, 1828.

Graham, George, Fleet Street.

Apprenticed to Henry Aske, July 2, 1688; chosen on the Court of Assistants, April 2, 1716; served the office of Warden, 1719-21, and chosen Master, September 29, 1722; died November, 1751, aged seventy-five, and was buried in Westminster Abbey.

96. A very sound Jewelled Vertical Movement, enamelled dial, No. 5,074.

Presented by Sir John Thorold, Bart.

Grant, John (the elder), Fleet Street.

Apprenticed to Alexander Cumming, his uncle, to whom he succeeded in business; elected on the Court of Assistants, October 9, 1809; served the office of Warden, 1810; died May 4, 1810.

97. A Gold Lever Watch, in double case, No. 1,479; weighs 2 oz. 11 dwts. 2 grs.; old standard. This watch has a double roller escapement, a triangular ruby pin working in fork of lever, the small roller below being slit half-way down to allow guard-pin to pass. The teeth of escape-wheel are upright, and are shaped somewhat like Arnold's cycloidal tooth-wheel, the action of the pallets being on the inside edges of the teeth. The pallets are fixed into arms forming a sort of fork working inside the escape-wheel teeth. This is one of the early attempts at the *detached* lever escapement.

Presented by his son, John Grant, October 12, 1874.

98. Gold Lever Watch, double bottom, No. 2,802; weighs 3 oz. 6 dwts. 2 grs. This watch has a double roller-escapement, the ruby pin being placed behind instead of in front, as in the ordinary lever escapement, and the fork of the lever carried round the balance-staff, the ends being turned up so that the ruby pin, which is perfectly square, acts between them. A small roller is placed below, partly filed away, to allow the guard-pin to pass. The escape-wheel is placed vertically, being driven by a contrite wheel, the pallets placed one below the other, very similar to Vulliamy's clock-pin escapement; a delicate banking-pin adjustable is secured to the top coil of pendulum spring, which acts when necessary on the spring-stud. Each of these specimens has a compensation-balance and cylindrical spring, and they are altogether of the highest character as regards workmanship.

Presented by his son, John Grant, October 12, 1874.

99. Curious Lever Movement, with two balances, connected by a tooth-wheel, with two pendulum springs acting in contrary directions, with initials, "J. G., May, 1800;" figured in Cumming's works.

Presented by his son, John Grant, 1850.

100. Silver Double-case, Open-face Watch, with enamel dial, vertical escapement. This watch has a very peculiar mode of recording the time as a repeater, by simply turning the pendant gently round from left to right as far as it will go, counting the number of ticks it makes on its return, which corresponds with the hour indicated on the dial by the hands, the pendant returning of itself. It is believed to be unique, and is curious from the singular method adopted to cause it to repeat the hours.

Presented by his son, John Grant, 1873.

Grape, John, London.

101. Plain Vertical Movement, with square pillars. Marked CX.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Gray, Benjamin, London,
Watchmaker to King George II.

102. Vertical Repeating Movement, enamel dial and silver rim. N. X. I.

103. Plain Vertical Movement, dial and hands, No. 457, made in 1737.

Presented by B. L. Vulliamy, 1849.

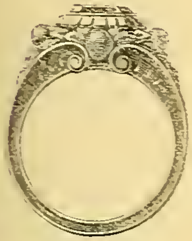
104. Gold Repeater, with Apollo's Head at the back. The running train between the plate and dial, marked R. S. C. Made originally for Sir Peter Somes, May 1, 1732.

105. Silver Pedometer, silver dial. Has the following inscription on the back:—

"Made by B. Gray, Clockmaker to George II. Given to the Company of Clockmakers by his Great-Grandson, B. L. Vulliamy, 1849."

(To be continued.)

MONTHLY SUPPLEMENT OF DESIGNS.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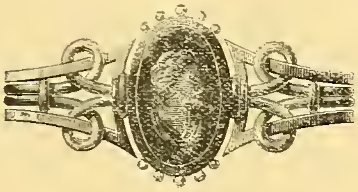
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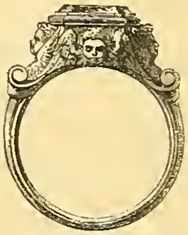
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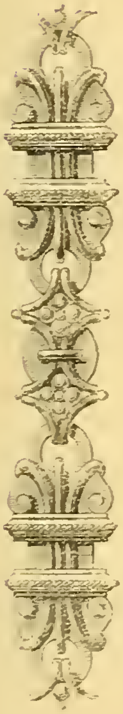
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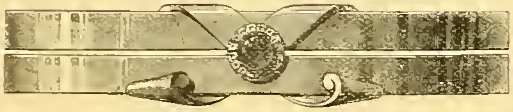
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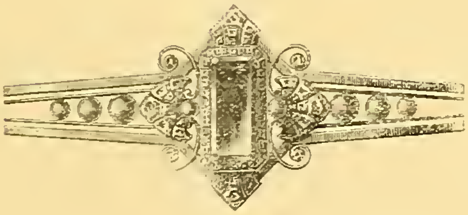
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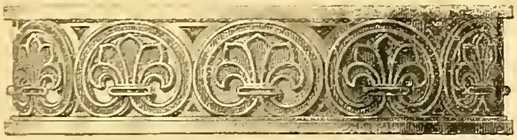
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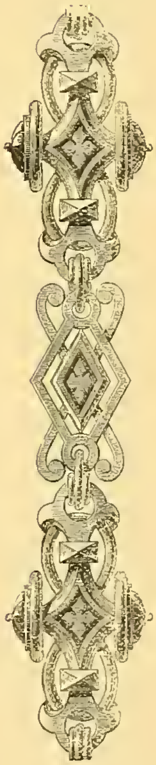
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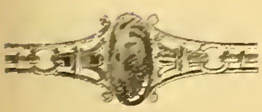
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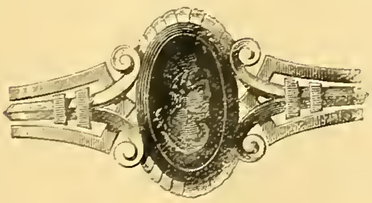
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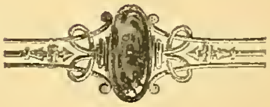
No. 93.

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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ILLUSTRATED SUPPLEMENT :—Designs for Modern Jewellery.

No. 84.—Vol. VII.] MAY 5, 1882. [Subscription, 5s. per Annum. Post Free.

The Future of the English Watch Manufacture.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

I presume no apology is required for using the word manufacture instead of trade, as whatever may happen to the manufacture in England, the watch trade of England will always be a large and flourishing one. For many years the watch repairing has been a more important item of business than the manufacture, and the distribution of foreign work, I suppose, will always be a very large source of profit and trade; may it never grow less, I hope; but there is no reason why the English manufacture should not flourish and expand to at least equal magnitude. My interest in Mr. Poole's articles has been aroused by the fact that he is opposed to the factory system and machinery, and yet the future and much of the present trade is dependent on that system. He is, I think, about the only intelligent watchmaker in England who needs converting; and, judging by the tone of his last letter, he only needs a little longer time to convert himself; or, as he says, some inducement to act as pioneer in the opposition ranks, in order that, like Favre Perret, he may return as a leader in the trade to urge his countrymen to go in for machinery.

I beg to assure Mr. Poole that he need not waste time and money in visiting America to learn the merits of their system and machinery; they are well proved and in daily operation in at least six places in England. As the pioneer, myself, of all the pioneers on this subject in Europe, I beg to assure Mr. Poole there is no room for another. The pioneer business has been overdone for some years, but there is room for any amount of intelligence and capital to be applied in importing American machinery and ideas, and following the line I have indicated unswervingly, during the last quarter of a century. As a new generation of watchmakers has sprung up since I went into this subject as the work of my life, a pardonable egotism may be allowed in referring to it, as it was not an easy task; if it had been, many would have done it and I should have left it alone. Mr. Poole says he has been invited by the Waltham Company to visit their factory. He need not consider it a compliment unless the policy of the Company has changed; quite the reverse. Intelligent mechanics, likely to understand and make practical use of what they see, have never been encouraged to visit Waltham; but people of influence, press writers, and all who could give good advertisement in exchange for the courtesy shown, have always been welcome. When I was at Waltham in 1864, Mr. Robbins bound me not to reveal or make any business use of what I saw or learned there; and I was in America four years instead of a few months, because

I did not wish to injure the American Watch Company, believing that the enterprise, then, could have been extinguished by English capitalists working on the same lines, and fighting them with their own weapons. Could a word of mine abolish the American factories and set them up in England, I would not utter it; though I will never rest content until I see all they have done done here, cheaper and better.

It was not until I went to the Elgin National Watch Factory, built on the Illinois prairie, thirty miles from Chicago, that I felt free to return to England, or make use of what I had learned. At that time, the Elgin machinery was in advance of Waltham; the machinists and the whole staff, fresh from Waltham, using the experience gained, introduced improvements decidedly in advance of what was done up to that time, and, like all new brooms, there was something about the Elgin watches which pleased the trade; and as this factory did not have to advertise their work to any extent, but had the advantage of what was done by the Waltham Company for American watches generally, they succeeded in doing a trade which is fast approaching in extent that of Waltham, and the sectional patriotism of Western men is pleased in owning a watch that is produced on their own prairie. At that time, the Elgin factory had hardly commenced supplying the public, its success was problematic, and the principal men there, knowing I was returning to England, gave me every encouragement to get the question agitated well amongst the trade in London, and if I succeeded they were quite willing to come and bring their factory with them. With this machinery, and a staff of about two dozen superintendents, several of whom I had known as Clerkenwell boys, who had, with more enterprise and intelligence than their employers in Clerkenwell, tried the new system in America, Mr. Mosely, the then superintendent and maker of all the machinery there, and much of that at Waltham, assured me he could, if located near London, secure the watch trade of the world. This, perhaps, was exaggeration; but the advantages of the London name and reputation, now principally used to decorate foreign work, is a powerful item of success.

There is an impression amongst the English watch trade that the Elgin Company is defunct, owing to their having left their London office and given up the English trade. The trade, however, will find they are very much alive when the next American panic spoils the watch trade there for a time; and when English watchmakers have little to do, they will find Elgin watches in the market in thousands, unless we get out watches that will render American watches superfluous. What influence I may have had in promoting machine watch making I cannot gauge; and so long as the thing is done, and done well, it matters not who gets the honour and profit. Had I been a capitalist, I should, perhaps, have imitated others by a rigid silence on the subject; but there is one form of English cant usually apparent in discussing questions of introducing machinery conspicuous by its absence, and that I claim as entirely my own doing. It is usual to represent the capitalist and employer burning with enthusiasm to maintain English trade and introduce improvements, and the English workman is represented as doing all he can to put difficulties in the way and refusing to co-operate; but in our trade we see the reverse of this, the workmen asking for system and the employment of capital and machinery, and the watch manufacturers and large retailers opposing it, because it abolishes their supremacy, and wants capital too large for any one individual in the trade to control or risk safely.

The watch trade is peculiarly unfortunate. Influence and prejudice at the top, knowledge and truth at bottom. I have discussed the merits of American watches in every town and village in the kingdom during the past twelve years, and never found a practical watchmaker who could not understand and appreciate their merits. But what have our leading men in the trade done in the question? Three names most prominent in the trade and its Institute for the dissemination of truth, theoretical and practical, are to the public most known as the leading opponents of the three questions which are changing the destinies of this country. The President of the Horologists is the sworn foe of trades unions, and yet the profession of which he is a distinguished ornament is the embodiment of trades unionism. On the question of machinery and American watches he is perfectly right, and I claim some of the merit of his conversion, as he had no sympathy with American notions and machinery when he honoured my lecture on American watchmaking, in 1868, by presiding on the occasion. Then we have Mr. J. Jones, a man for whom I have the highest respect, whose three-guinea lever was to be the final blow in the battle of watches, Swiss *v.* English. The Swiss, like the Americans, seem none the worse for the final blow. I suppose the mountain air or republican principles revives them under blows which double up John Bull horologically. Jones and Co., on the American system, might have done something to stem the tide of foreign invasion; but Mr. Jones has been engaged in putting down co-operation. It is still, however, alive; and concerns which originated with a few workmen, and some odd pence saved from the publican, now handle millions of money, and multiply, like American watches.

It may interest your readers to know that, in addition to introducing American ideas and machinery for watchmaking, I claim to be the originator of co-operative watchmaking in this country. Mr. Poole attended the inaugural meeting in Clerkenwell and opposed us, but gave us a splendid testimonial when he asserted that the specimen we offered for 50s. could not be produced for less than £5. He meant *he* could not produce it; but he had not the opportunities or abilities in that direction we had, and I think he has since seen his error and acknowledged it. Let him go in for co-operation in watchmaking—there is a wide field open,—but not as a pioneer; the thing is too old now, but is capable of immense expansion. I have been invited to a meeting of the Guild *v.* Co-operators, who meet to discuss what they can do with the enormous capital that is accumulating in co-operative societies, and I shall propose that a million or two be put into the watch trade. Those who are undecided as to whether they will oppose progress should make up their minds at once. Hitherto, I have not actively promoted the entering of capital to any great extent, because we had not accumulated the necessary brains and intelligence to take care of it, and English watchmakers would rather go bankrupt fadding in their own way, than make a fortune on lines plainly laid down by other people who have succeeded. But capitalists are not like that; show them a profit and they will flock with money. The number of men I have seen running about the City for something in which they can invest a few thousands is almost as distressing as the other sight, much too common at present, of workmen seeking a job in vain. An intelligent man may serve them and himself by causing them to co-operate for their mutual good. The finest lever escapement maker in the world is idle half his time, and people with money say they know not where to get a reliable watch. But I had nearly forgotten our third horological leader, Mr. Glasgow, who has always been a consistent opponent of American watches and machinery. I could always, in times past, rely on his taking the opposition side in discussing the subject, which served the useful purpose of allowing others to get a fair notion of the merits of the question; and the Waltham Company never came out of the battle, except as gainers of a cheap advertisement. A bold antagonist is a splendid advertiser. Undeserved abuse is the high road to fame and fortune, but I have noticed of late a sad falling off in the old spirit of antagonism. It was Mr. Guye who, I think, converted him by showing him some beautiful machine pivoting he had done; and when I, full of enthusiasm, having visited Mr. Guye's factory, was delighted with not only the pivoting but the escapements, all being well finished and interchangable in all parts, and not varying under the test of a powerful microscope more than the five-thousandth of an inch, he rebuked me for asserting that Mr. Guye had surpassed the Americans in their own methods, in these words: "Mr. Guye has sunk money and had no return as yet, and cannot expect to equal the Americans with their large capital and experience; and there can be no doubt these American watches, for ordinary purposes, go well and give no trouble." "What becomes of your opposition?" I ventured to ask. "Oh, in first-class work they are nowhere, compared with either the English or Swiss." More judicious praise than this was never given by the warmest admirer of American watches; and supposing American watches are as successful as fine timekeepers as they are as useful every-day watches, there is still room for criticism, which has a value for the Americans incalculable, as a factory can scarcely criticise itself, and the magnitude of its operations renders it impervious to the remarks of those who are its agents and customers. The vast improvement in the lower grades of watches in style and finish, since their advent in this country, is due to this criticism. Having to compete with workers, amongst whom there is constant competition to carry out an ideal excellence, the factories would probably find it difficult to exist, did they depend on ideas and abilities contained within themselves. One or two leading minds and a host of hands are all right whilst their leaders are all right, but administrative ability is apt to extinguish mechanical ability, or give it but poor recognition. The founder of the American system, Mr. Dennison, has been in England these twelve years or more; and though I have heard of large incomes, numerous changes by the leading mechanical minds in the factories do not indicate any special satisfaction with their position, and I never heard of any one in a factory who had any pleasure in his work. The quantity turned out and and the money earned are the leading features. That pride of work prominent in the hand or home worker is absent. The love of the art which is shown by the support of horological literature is rare. An article on some practical detail of work or improvement in tools from factory proprietors, who are not slow at utilising useful notice, is unknown at present, and on the part of foreman or workman would amount to high treason, I suppose, if discovered. A certain amount of intelligence, not the highest intelligence, is required in a factory. Good performance is not always the highest test of horological ability; the horological artist may be looked upon as a mechanical acrobat, and executes such feats of skill, with a taste and neatness that astonish and excite the admiration of those capable of judging, and this is what the American watch lacks. The fitting and working parts are all right, but when it comes to finish and high price there is a falling off, and always will be whilst labour commands the price in America, and usefulness is the leading trait in the national character. An American would scorn to waste his time on the fads and intricacies which make up the greater part of ornamental and useful art in Europe. Such criticism as Mr. Glasgow's is useful; and I fail to perceive the usual American astuteness in resenting and punishing it, and should be inclined to consider that a blundering Britisher only would invoke the Law of Libel to defend the character of Waltham watches, which are not attacked by Mr. Glasgow on the present occasion.

Upon reading the article, I immediately recognised the watch as one produced in Boston itself, and felt it my duty to ask to see it, as I had a good opinion of the work produced by the firm years ago, which, though high in price then, was uniform in quality. I had an idea, for some time past, of introducing it here; and, in fact, some time since inquired of my American confréres as to the progress it had made, as the watch wound the same way as English fusee watches. I thought a good trade, and popular prejudice pleased, would have been the result. I was told the watches were as dear as ever, and if the one I have seen is a fair specimen, the watch, unlike the Waltham, has retrogressed in character whilst maintaining its price; and this accounts for its non-appearance in the English market. Any watch jobber, aided by a whitesmith, could produce a better watch without machinery, and the knife-board and flander's brick will finish steel work better and flatter than any I could perceive on this; and the improved screw regulator is an infringement of an American patent of my own, about which I shall have more to say elsewhere. Mr. Glasgow's criticism, I thought, was severe before seeing the watch; but I can give a criticism on it which would astonish even those who know his style. If the Waltham Company undertake to defend all American watches, they will have to do battle for the Waterbury watches next; though these watches have their use and some original ideas, though the modesty involved in patenting the duplex escapement and paper dials is unique. Well, there are large numbers of juveniles who will take watches to pieces to gratify the rising mechanical genius of America and England, and these are well adapted to supply that want; but the degradation of watch-work ensures the degradation of watchmakers and the reward of their skill, and it is high time that all interested in the art—workmen, manufacturers, shopkeepers, and capitalists, co-operated to produce the best results at the most moderate prices, of work of all grades, never producing work for mere sale purposes; and by acquiring a name for only the really good and useful, find a present return for capital, and an ever-increasing field for the employment of skill and labour. The nearest approach to this ideal has been the Waltham and Elgin Companies—father and son, I consider them; and they can only be surpassed by a London Company, worked on their lines. Should any of your readers desire to promote such a Company, by giving their influence, time, capital, or labour to inaugurate one, I should like to hear from them; as in developing what we already possess, much can be done. In many points we are ahead of America; in reproducing quantities uniformly, notably in movements, jewels, dials, escapements and cases, we can surpass America, and do, in fact, supply her with her best and cheapest parts; but we fail in combining the whole together and bringing the watches before the world with influence and power, and securing public confidence and more than life-long lease of trade and prosperity. This will restore our self-respect, for our national vanity is hurt and will assert itself, and refuse to allow that we, the Horological Nation, *par excellence*, are commercially annihilated, and, far from being the head and front, are scarcely a respectable tail worth acknowledging.

Yours truly,

H. GANNEY.

107, Mansion House Chambers, E.C.

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In order to meet the requirements of their increasing business, the Seth Thomas Clock Co. have removed their London Agency to a new and handsome warehouse, No. 7, Cripplegate Buildings, Wood Street, where it will be continued under the management of Mr. R. M. Marples, who has represented them for the past twelve years in this country. Mr. Marples relinquishes some other agencies in order to devote himself entirely to the business of the Seth Thomas Clock Co., which we believe is the oldest, as it is unquestionably the best, of all the American clock companies.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. BUSH, HULL.

(Continued from page 150.)

SUPPLEMENTARY TABLES for the standarding of silver on p. 149 in last number of the journal.*

Table for the addition of Fine Silver to the excess of Copper in bullion, assayed and reported *Worse*, in order to make it into Standard.

		oz.	dwt.	grs.	
To 1 oz. Copper	.. .. add	12	6	16	Fine Silver.
19 dwt. ,,	.. .. ..	11	14	8	,,
18 ,, ,,	.. .. ..	11	2	0	,,
17 ,, ,,	.. .. ..	10	9	16	,,
16 ,, ,,	.. .. ..	9	17	8	,,
15 ,, ,,	.. .. ..	9	5	0	,,
14 ,, ,,	.. .. ..	8	12	16	,,
13 ,, ,,	.. .. ..	8	0	8	,,
12 ,, ,,	.. .. ..	7	8	0	,,
11 ,, ,,	.. .. ..	6	15	16	,,
10 ,, ,,	.. .. ..	6	3	8	,,
9 ,, ,,	.. .. ..	5	11	0	,,
8 ,, ,,	.. .. ..	4	18	16	,,
7 ,, ,,	.. .. ..	4	6	8	,,
6 ,, ,,	.. .. ..	3	14	0	,,
5 ,, ,,	.. .. ..	3	1	16	,,
4 ,, ,,	.. .. ..	2	9	8	,,
3 ,, ,,	.. .. ..	1	17	0	,,
2 ,, ,,	.. .. ..	1	4	16	,,
1 ,, ,,	.. .. ..	0	12	8	,,
21 grains ,,	.. .. ..	0	10	19	,,
18 ,, ,,	.. .. ..	0	9	6	,,
15 ,, ,,	.. .. ..	0	7	17	,,
12 ,, ,,	.. .. ..	0	6	4	,,
9 ,, ,,	.. .. ..	0	4	15	,,
6 ,, ,,	.. .. ..	0	3	2	,,
3 ,, ,,	.. .. ..	0	1	13	,,
1 ,, ,,	.. .. ..	0	0	12	,,

Table for the addition of Copper to Bullion, assayed and reported *Better*, in order to reduce it to Standard.

		dwt.	grs.	
To 1 oz. Fine Silver	.. .. add	1	16	Copper.
19 dwt. ,,	.. .. ..	1	13	,,
18 ,, ,,	.. .. ..	1	11	,,
17 ,, ,,	.. .. ..	1	9	,,
16 ,, ,,	.. .. ..	1	7	,,
15 ,, ,,	.. .. ..	1	5	,,
14 ,, ,,	.. .. ..	1	4	,,
13 ,, ,,	.. .. ..	1	2	,,
12 ,, ,,	.. .. ..	1	0	,,
11 ,, ,,	.. .. ..	0	22	,,
10 ,, ,,	.. .. ..	0	20	,,
9 ,, ,,	.. .. ..	0	18	,,
8 ,, ,,	.. .. ..	0	16	,,
7 ,, ,,	.. .. ..	0	14	,,
6 ,, ,,	.. .. ..	0	12	,,
5 ,, ,,	.. .. ..	0	10	,,
4 ,, ,,	.. .. ..	0	8	,,
3 ,, ,,	.. .. ..	0	6	,,
2 ,, ,,	.. .. ..	0	4	,,
1 ,, ,,	.. .. ..	0	2	,,
12 grains ,,	.. .. ..	0	1	,,
6 ,, ,,	.. .. ..	0	½	,,

In anticipation of the general adoption of the Decimal System of weights and assay reports, the following table gives the proportions of .Copper and Fine Silver to compose Standard.

1 ounce Copper 12·333 ozs. Fine Silver.

Oopper.	Fine Silver.	Copper.		Fine Silver.	Copper.	Fine Silver.
·9 oz.	11·100 oz.	·09 oz.		1·110 oz.	·009 oz.	·111 oz.
·8 ,,	9·866 ,,	·08 ,,		·986 ,,	·008 ,,	·099 ,,
·7 ,,	8·633 ,,	·075 ,,	Stndrd.	·925 ,,	·007 ,,	·086 ,,
·6 ,,	7·400 ,,	·07 ,,		·863 ,,	·006 ,,	·074 ,,
·5 ,,	6·165 ,,	·06 ,,		·740 ,,	·005 ,,	·061 ,,
·4 ,,	4·932 ,,	·05 ,,		·617 ,,	·004 ,,	·049 ,,
·3 ,,	3·700 ,,	·04 ,,		·493 ,,	·003 ,,	·037 ,,
·2 ,,	2·466 ,,	·03 ,,		·370 ,,	·002 ,,	·025 ,,
·1 ,,	1·233 ,,	·02 ,,		·246 ,,	·001 ,,	·012 ,,
		·01 ,,		·123 ,,		

COMPOUNDING GOLD AND SILVER ASSAYS.

To ascertain the mean quality of several bars of gold, or silver, of different assays before melting into one mass, proceed as follows:

Multiply each quantity by its assay report, and divide the aggregate products by the aggregate quantities, viz:

36 ozs. 1½ grs.	Better	=	22⅔ carats	=	805½
21 ,, 14 carat	Worse	=	8 ,,	=	168
9 ,,	Standard	=	22 ,,	=	198
15 ,, 3 car. 1¼ grs.	Worse	=	$18^{3}/_{16}$,,	=	$272^{13}/_{16}$
81 ozs. Gold.					81)1444$^{5}/_{6}$(17¾ car. *Ans.*

36 ozs.	..	·933 fine	=	33588
21 ,,	..	·333 ,,	=	6933
9 ,,	Standard	·917 ,,	=	8253
15 ,,	..	·758 ,,	=	11370
81 ozs. Gold.				81)60144(·743 fine = 17¾ *Ans.*

145 ozs. 12 dwts.	Worse	=	210 dwts.	=	30450
32 ,, 3 ,,	Better	=	225 ,,	=	7200
35 ,,	Standard	=	222 ,,	=	7770
16 ,, 3 ,,	Worse	=	219 ,,	=	3504
228 ozs. Silver.					228)48924(214½ = 7½ dwt. W.

145 ozs.	..	·875 fine	=	126875
32 ,,	..	·940 ,,	=	30080
35 ,,	Standard	·925 ,,	=	32375
16 ,,	..	·910 ,,	=	14560
228 ozs. Silver.				228)203890(·894 fine = 7½ dwt. W.

When there are ounces and dwts., or ounces and decimals, in the quantities, convert every quantity into dwts. or the corresponding decimals, and proceed as in example.

EXAMPLES FOR CALCULATING VARIOUS ASSAY REPORTS.

GOLD ASSAYS.

Old Troy Weight and Standard Report.

9 ozs. 14 dwts. 18 grs. reported 3 carats 2¼ grs. *Worse.*

3 carats 2¼ grs. off 22 carats = 18 carats 1¾ grs.

	£	s.	d.
18 c.	3	3	9
1¾ gr.	0	1	6½

		£	s.	d.
Value per oz. ..	3 5 3½ multiplied by 9 ozs. =	29	7	7½
,, ,, dwt.	20)3 5 3½(3s. 3⅛d. by 14 dwts. =	2	5	7¾
,, ,, gr.	24)0 3 3 (0s. 1½d. by 18 grs. =	0	2	3
	Total Value ..	£31	15	6¾

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* ERRATA.—The following errors appeared in our last issue on account of Author not receiving "Proof" in time for revision:—

Page 148. 1st Col.—Paragraph starting "Some' and ending "ounce," for "millions," read "milliemes."

The second portion of table commencing "Fineness in Carats," should read "Fineness in *Grains*"; and immediately underneath, instead of "3⅞ = ·010," read "3⅞ = ·040."

Page 149. 1st Col.—3rd line from top, for "2½ dwt.," read "3½ dwt."; in same line, for "227½ parts," read "225½ parts."

5th line from top, for "10 or 14½ dwts.," read "10 *oz.* 14½ dwts."

8th line from bottom, for "or would," read "or *the report* would."

4th ,, ,, ,, the word "same" should be omitted.

2nd Col.—12th line from top, for "3 ,, 208," read "8 ,, 208."

23rd line from top, should read "which *is* computed, &c."

About two-thirds down, in "Take the report .. 18," read "18½."

Page 150.—1st line, for "worse, 1⅓ grain," read "worse, *add* 1⅓ grain."

2nd line, for "of silver," read "of copper."

Decimal Weight and Millieme Report.

9·365 ozs. reported ·576 Fine Gold.

	£	s.	d.		£	s.	d.
1 oz. ·500 fine	2	2	6				
,, ·070 ,,	0	5	11				
,, ·006 ,,	0	0	0½				
Value per ounce	2	8	5½	multiplied by 9 ozs. ..	21	16	1½
,, ,, 1 oz.	2	8	5½	= 581d.			
,, ,, $\frac{1}{1000}$,,				$\frac{580}{1000}$ | $\frac{58}{100}$ | $\frac{29}{50}$d.			
,, ,, $\frac{365}{1000}$,,				365 multipl. by 29 divided by 50 = 212d. =	0	17	8
				Total Value ..	£22	13	9½

SILVER ASSAYS.

Old Troy Weight and Standard Report.

148 ozs. 15½ dwts. reported 12½ dwts. *Worse.*

12½ dwts. off 222 dwts. = 209½ dwts. = 10 ozs. 9½ dwts.

	s.	d.		£	s.	d.
1 oz. 200 dwts. fine	4	2				
,, 9 ,, ,,	0	2¼				
,, 0½ ,, ,,	0	0⅛				
Value per ounce	4	4⅜	multiplied by 148 ozs. =	32	5	11½
,, ,, dwt.	20)4	4⅜(2½	by 15½ dwts. =	0	3	2½
			Total Value ..	£32	9	2

Decimal Weight and Millieme Report.

148·775 ozs. reported ·877 Fine Silver.

	s.	d.		£	s.	d.
1 oz. ·800 fine	4	0				
,, ·070 ,,	0	4				
,, ·007 ,,	0	0⅜				
Value per ounce	4	4⅜	multiplied by 148 =	32	5	11½
,, ,, 1 oz.	4	4⅜	= 52d.			
,, ,, $\frac{1}{1000}$,,			$\frac{50}{100}$ | $\frac{5}{100}$ | $\frac{1}{20}$d.			
,, ,, $\frac{·775}{1000}$,,			775 multipl. by $\frac{1}{20}$d. = 38¾d. =		3	2½
			Total Value ..	£32	9	2

PARTING ASSAY.

14 ozs. 6 dwts. {Fine Gold 1 oz. 11 dwts. 6 grs. in the lb. troy.
{Fine Silver 6 ,, 3 ,, 12 ,, ,, ,,

		s.	d.		£	s.	d.
Fine Gold	1 oz.	7	1	multiplied by 14 ozs. =	4	19	2
	11 dwts.	3	10¾	,, ,, 14 ,, =	2	14	6
	6 grs.	0	1	,, ,, 14 ,, =	0	1	2
Fine Silver	6 ozs.	2	6	,, ,, 14 ,, =	1	15	0
	3 dwts.	0	0¾	,, ,, 14 ,, =	0	0	10½
	12 grs.	0	0⅛	,, ,, 14 ,, =	0	0	2
Value per ounce		13	7½	,, ,, 14 ,, =	9	10	10½
,, ,, dwt.		20)13	7½(8d.	,, ,, 6 dwts, =	0	4	0
				Total Value ..	£9	14	10½

The Bullion Dealers' account for old gold and silver offered for sale will fall somewhat short of these calculations, as the full mint-value is given in these tables (see pages 148 and 149 in last month's issue of this Journal), and a charge for melting and refining has to be taken into consideration, the deduction for which is generally included in the amount, as the charge depends on the fineness of the metal; the charge increases with less fine gold or silver, and decreases with more of the precious metals in the bullion.

(*To be Continued.*)

The Construction of a Simple but Mechanically Perfect Watch.*

By M. GROSSMANN, *Watch Manufacturer, Glashuette (Saxony).*

(*Continued from page* 154.)

168. The combined influence of these circumstances has created a desire to invent some means for setting the hands without any external push-piece, or, when keeping this latter, at least avoiding its principal defect—the liability of being pressed inward by casualties not under the control of the wearer.

The former category of devices have already been described and treated (136—143). In the latter direction the purpose is very well attained by some contrivances of recent date.

Some have the external push-piece of the common kind, a small pin fastened into the push-piece, vertical to the direction of its movement, which projects from the rim of the case, and reaches into a corresponding notch or hole of the rim of the front cover (hunting case). This prevents any displacement as long as the case is shut. If the front cover is open, the setting-wheel can be pushed in, and comes out afterwards by self-action, and is again secured by shutting the front cover.

Other watches have a round push-piece with a head, and this latter is prevented from being pushed in by a part of the rim of the front cover, which it overlaps slightly. This obstacle is removed with the opening of the front cover, as with the before-mentioned one.

Another device is actually getting great favour. It shows a pipe soldered into the middle rim of the case at the convenient place, and projecting beyond the outline of the watch and also to the inside of it. The push-piece, a simple, straight, and cylindrical pin, moves freely in this pipe, and is flush with the outer end of it, so that it would be inaccessible from the outside, if a small slit in the pipe did not allow of moving the push-piece with the nail of the thumb. This protected push-piece is very commendable, especially for open-faced watches. It has, indeed, only the one inconvenience—that with persons who do not bestow proper care to the cleaning of their pockets, filaments may introduce themselves into the pipe, and deprive the push-piece of its freedom, so that it does not come out after.

169. The form of the winding knob is subject to many influences of taste. Those watches, the setting of which is done by pulling the knob out, must have such a form as to prevent any pulling out when winding. But for all the other keyless mechanisms, a form of knob should be chosen which allows of applying the force on its greatest diameter. This not only utilizes the most favourable leverage, but also the place where the rifling of the knob is deepest, both circumstances facilitating the winding operation.

CONCLUSION.

From a long time since, there has been now and then a watchmaker, or even a manufacturer, who has tried to create something new and superior in the way of an eight-day watch This is certainly a very unfortunate idea. The advantage to be attained is very doubtful, for it is much more likely to forget the winding of a watch, if it is required but once a week, while the daily winding of the watch is a habit easily acquired and kept.

The practical difficulties for combining appropriate dimension and an elegant shape of a watch, with the exigency of sufficient power for running through a period of eight days, are not inconsiderable; but the most important drawback will be the inferiority of the timekeeping of such watches.

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The great difference of moving power between the first and the last days of the winding period cannot fail to show its influence upon the rate of the watch, and thus it seems that there are much worthier objects and problems for the skill and ingenuity of horologists, than the production of mere curiosities of this kind.

170. An accessory to watches of recent origin requires saying a few words about. It is an indication, to what degree the mainspring is wound up, or run down at any given moment.

The utility of this up and down indicator is obvious, especially for persons who do not keep to a certain regularity of treating and winding their watches.

For keyless watches it may be of less importance, since it is very easy and expedient to wind the watch again if there is any doubt about its having been wound.

The marine chronometers have the indicator without any exception, because it is of the utmost importance to prevent their running down.

The fusee movement offers great facilities for the indicator; it requires, in fact, but a pinion on the fusee pivot, and a wheel of proportionate number of teeth driven by that pinion. This wheel has to receive a hand on its pipe; nothing else is required for the purpose.

With the going barrel, however, the matter is rather difficult, because the barrel-arbor moves only when the watch is being wound, and stands still while the watch is running. A certain number of ingenious devices have been combined to this purpose, but it seems that the problem is not sufficiently studied as yet. All mechanisms of this kind require an additional height of the movement.

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The Worthies of Horology.

By C. Stuart Murray.

I.

THE Worthies of Horology, both in their lives and works, must kindle a pleasing interest in the minds of the scientific, the practical, and the amateur students of the Time-keeping art. When those who belong to the third-named class of devotees look upon the complicated productions of spring and wheelwork, and the more that they learn to understand the various causes and effects, disturbances, and contrivances to maintain and restore the equilibrium of action, there is one simple expression that fitly denotes admiration and surprise; that is,—"I wonder how such an instrument can be made at all!" How little do we think, when observing the "play" of the fine handicraft of our own time, of the amount of years and years of mental toil, the sleepless nights and wearying days, of skilled experiments that have been passed from one land-mark of the art to another in perfecting, we may say, what we look upon now with as little concern as a chair or a table. The men who evolved some advancing principle from the ever inventive brain, and reduced it to living practice, are really and truly the makers of landmarks in the history of horology. Although I have undertaken to weave into a readable web what facts and information I can procure upon the subject, every line that I write almost painfully impresses me with my own inadequacy for the satisfactory performance of the task The kind indulgence of the reader is therefore entreated, to enable me to float these papers over the turbulent waters of criticism, to the calm haven of their destination.

In treating of the Worthies of Horology, it will be necessary to travel much farther back in the world's story than some of us imagine; indeed, a great deal further back than at the first thought we have any idea of.

We have all read of the sun-dial of Ahaz, in relation to Hezekiah,—"Behold, I will bring again the shadow of the degrees, which is gone down in the sun-dial of Ahaz, ten degrees backward. So the sun returned ten degrees, by which degrees it was gone down." Isaiah xxxvii., v. 8. In the 20th chapter of the Second Book of Kings, nearly the same words will be found. Hezekiah was king of Judah, having succeeded his father Ahaz. Of Ahaz we know but little, and had he not been credited with the sun-dial, his name would not be so familiar to us. The first mention that we find of him is in the 16th chapter of the Second Book of Kings, which chapter both begins and ends his history. He was the son of Jotham, a former king, and commenced his reign when only twenty years old; he was king in Jerusalem for sixteen years, dying at the early age of thirty-six. He bore a very indifferent character, having laid his unhallowed hands upon gold and silver that did not belong to him, and otherwise despoiling the Temple. He entered into a treaty with the Assyrian monarch, who shared the plunder with him. He reigned about 742 years before the opening of the Christian era.

But a most singular omission is, that not one single word can I find in the Bible how the dial was invented, who did it, or who made it. Ahaz, being a warlike king, would hardly have given much of his fighting time to scientific discovery; therefore, the question must remain unanswered, as to who made the "dial of Ahaz." That artist, whoever he was, must be enshrined as one of the oldest horological "Worthies" on record. Although the name of the maker of the first sun-dial is unknown, we are more fortunate with respect to those who introduced it to the classic nations, with whose history we are better acquainted. We are told that the first sun-dial was established at Lacedemon, in Greece, by Anaximander, about the year 545 B.C. Taking that to be correct, the Greeks would have had sun-dials about two-hundred years after the date of that of Ahaz, as mentioned in the Bible. This Anaximander was the kinsman, pupil, and successor of Thales, of Miletus. Now Thales was one of the renowned seven wise men of Greece, said to be descended from Cadmus, who introduced the use of letters among the Grecian people. Thales, like all the philosophers of those ages, spent the early part of his life travelling in search of knowledge, and resided for some lengthened period in Phœnicia and Egypt. In those countries he learnt geometry, astronomy, and all of physical philosophy that was then known. It is related of him that he measured with exactness the height and extent of one of the pyramids. His astronomical work was great for his time, as he is said to have been the first of men who accurately calculated an eclipse of the sun. Nor did the value of his learning, as bearing upon astronomical horology, end there. He discovered the solstices and the equinoxes—the summer longest, the winter shortest, and the spring and autumn equal day and night periods of the year. He divided the terrestrial sphere into five zones; modern astronomy has maintained them. Thales, notwithstanding his intense study, had a strong vein of humour in him. His mother took it into her head to press him to take unto himself a wife; but his invariable answer was, that he felt too young for the cares of matrimony. From year to year the maternal advice was renewed, until he changed his excuse, and told her that he was then too old! He died in the ninety-sixth year of his age.

Such was the philosopher from whom Anaximander received the crowning course of his education, and became a horological Worthy in the construction of sun-dials. He was the first who made astronomical spheres, although he contended that the earth was cylindrical in form, that the earth moved, and that the moon received her light from the sun. He made the first geographical map that history mentions. He died in the sixty-fourth year of his age, and his memory was greatly honoured by his countrymen.

Herodotus, the great historian who flourished about a century after Anaximander, says, that the Greeks borrowed from the Babylonians the divisions of the day into twelve parts. The question that is now suggested is, how was that division effected? Was it done by sun-dials or by clepsydræ? Upon it, no doubt, rests the basis of their chronology. The division of the day, as before mentioned, was evidence of a high state of intellectual advancement at that very remote period of the history of mankind. In the 10th chapter of Genesis, Babel, or Babylon, is mentioned as being a part of the dominions of Nimrod. I am now speaking of the kingdom of Babylon, as apart from the city. The latter was built by Semiramis, who had a kind of palace town constructed for her residence, and this city became the capital of the ancient, powerful Assyrian monarchy. This famous city stood upon the banks of the Euphrates, nearly fifty miles south of the modern Bagdad; it was at the greatest altitude of its power and grandeur during the reign of Nebuchadnezzar, in the sixth century before Christ. Herodotus says that "it was the most celebrated city of Assyria." The kings of the country made it their residence after the destruction of Nineveh. The walls had a hundred gates made of brass, whilst the houses were three and four stories high, and the river Euphrates ran through the town, having a bridge across it built of huge masonry, and, wonderful to say in these days, a tunnel of a roadway underneath. This tunnel was twelve feet high, and fifteen feet broad. The city walls were built of brick and bitumen, and the plan was a square. Each side of this square was twelve miles in length. This would give an interior area of a hundred and forty-four square miles; indeed, so extensive was the city, that when it was taken by Cyrus, the inhabitants of the central part was not aware of the fact until far on towards the close of the afternoon. Some of its bricks and other articles may be seen in the British Museum. These particulars are mentioned to raise the wonder how it was that a people so powerful and magnificent, whose astronomical intelligence was able to divide the day into twelve equal portions, the year into twelve months, and the Zodiac into twelve signs, should have literally missed the invention of horological mechanism!

The Babylonians began the civil day at sunrise, whilst the ancient Egyptians began it at midnight, as we do now. Of course, with respect to Egypt, that would necessarily require some method of arriving at the midnight hour. The Chaldeans—another name for the Babylonians—were famous for their knowledge of astronomy. They worshipped the sun, moon, and the five planets known in their day, mixing up with it an equal quantity of astrology, or what we would call "planet ruling." I may just mention here, apart from horology, because the information is of itself interesting, that in the great ancient city of Babylon arose the tower of Babel—the two names being synonymous—which tower has been calculated to have reached the height of five thousand paces, and to have had the same circumference. What is further known of it states that the ascent was by means of outside spiral roadways, so broad that the chariots of the time could turn and pass each other. Its building was stopped in the manner that we have all read about.

The Babylonians are better known to the modern world by the name of the Chaldeans, Chaldea being the name of the south-west portion of the Babylonian empire. It extended along the Euphrates to the Arabian Desert, and by means of waterways could reach India across the Persian gulf. This ancient country was famous for the manufacture of superior linen, cotton, and woollen cloth, and for carpets. Carving in precious stones and ivory was largely cultivated; seal-rings and walking-sticks being much in use among the wealthy classes. And yet, is it not strange, almost beyond belief, that a people so highly skilled should never have hit—or rather stumbled—upon the way of making some kind of simple clock!

They employed a lunar year for all ordinary purposes, and a movable solar year for astronomical observations. The priests were the learned caste; they were acquainted with the planetary movements, with solar and lunar eclipses, with earthquakes, and other natural phenomena, which learning was transmitted from father to son; and yet, with all these great parts of knowledge, they never appear to have shown the least idea of the horological use of the pendulum! Surely, there must have been, if we knew all, several Worthies of Horology throughout that immense empire!

Side by side with the Chaldeans, and century by century, were the Egyptians, of whose ancient history we have fuller and more accounts than of any other ancient nation. It is not at present a settled question among the learned as to whether the first-named, or the Egyptians, invented the sun-dial. It is believed by more than one astronomer, that the architect of Cheops, who built the great pyramid, was the first horological "Worthy" known to the ancient world. Mr. Proctor, an astronomical authority of large practical experience, has concluded, by a series of papers in his own publication, *Knowledge*, that it was neither more nor less than a kind of celestial "look-out"—virtually, a sun and star dial. This pyramid was a costly observatory, if we can rely upon the best obtainable accounts. It is said to have swallowed up the labour and a great number of the lives of three hundred and seventy thousand men at work every day for twenty years. The sun-dial part of it was, that one of the great galleries ran in a straight upward line to the top, and opened in such an ending that the sun at mid-winter, at the vernal equinox, and at mid-summer, cast a shadow-line, somewhat like that of the style of an ordinary dial, as it passed by the opening. With respect to noting the celestial observations, Mr. Proctor raises the curiosity of the modern horologist—"Our modern astronomer has his clock, beating seconds with emphatic thuds, and he notes the particular thuds at or near which the star crosses the so-called wires in the field of view (really magnified spider lines). We may be tolerably certain that the observer in the Grand Gallery had no such horological instrument. But he *must* have had a time indicator of some sort (and a good one, we may notice in passing), or the care shown in the construction of the Gallery would have been in great part wasted. Now, whence could his sounds have been conveyed to him but from the upper end of the Gallery? A time-measurer of some sort—probably a clepsydræ, or water-clock, must have been set there, and persons appointed to mark the passage of time in some way, and to note also the instants when the observer or observers in the Great Gallery signalled the beginning or end of transit across the Gallery's field of view."

Now, that opens up another aspect of the question; and that is, whether sun dials, or clepsydræ, were first invented? Arago, the eminent French astronomer, says, that "the clepsydræ, according to all appearance, are of a date still more ancient than sun-dials." Whatever they were, their form and mode of action are lost, as well as the name of the Worthy who invented and constructed them.

I have been searching geographical authorities about the height of the Great Pyramid, and some of them give the height in varying measures, from six hundred to eight hundred feet, with a corresponding length to each of the four sides. We are here lost with respect to the names of the Worthies of Horology of those ages; but that there were such, the high state of civilisation and the arts forbids us to doubt. And here we will now leave the most ancient part of our subject; in our next, we will all go into the classic world.

(*To be continued*).

Lectures on Watch and Clock Making.

PREPARATORY FOR THE ELEMENTARY EXAMINATION OF THE CITY AND GUILDS OF LONDON INSTITUTE IN MAY, 1881.

Delivered at St. Thomas Charterhouse School by I. HERRMANN on Monday Evenings, from October 25th.*

(Concluded from p. 165).

THE DOUBLE ROLLER.

LET R and W (Fig. 67), represent the centres of motion of a balance and pallet. Let $\angle a$W R be $\frac{1}{2}$ the angle of impulse contact of the lever, and $\angle\ b$ R W $\frac{1}{2}$ the impulse contact of the roller; then c, being the point of inter-section of W a and R b, will represent the centre of the ruby-pin. It is evident, that the guard pin must be placed along the line W a, and is limited in its approximation to the circumference $m\ n$, by the thickness of material that would be needed to make the ruby-pin hole sound, with a crescent of sufficient depth. Let p be the pin and position. Supposing that the lever is resting against the banking pin, when p is in the position shown in Fig. 67, then $\angle\ r$ W s would represent its angular clearance, or play. Now, let $x\ y$ represent the guard roller of a double roller action, whose radius is equal to the impulse radius. Instead of a guard pin, as in the ordinay table roller as shown in $m\ n$ and p, it is general to make the guard pin like a spear-head or dart, shown at c. In this case, the angular measure of the clearance would be represented by $\angle\ s$ W a, which will admit of a far more delicate locking depth on the pallet.

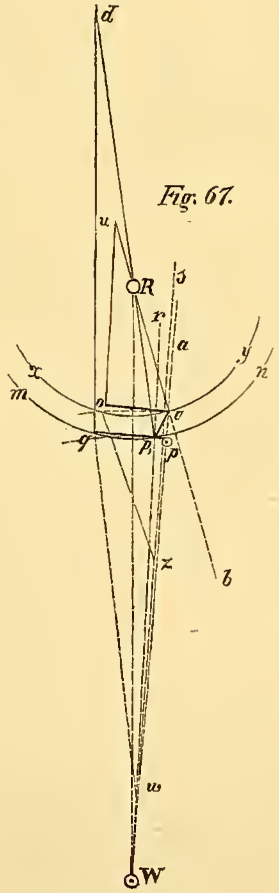
Fig. 67.

It is evident that the circumferential force of the lever must be less at c than at p.

Let $o\ c$ represent the former, and $q\ p$ the latter.

Draw $q\ d$ parallel to W p, meeting p_1 R produced in d, and complete the parallelogram $q\ d\ p_1\ w$. Then $p_1\ d$ represents the pressure on the roller by the guard pin, and $q\ w$ the pressure on the pallet pivots.

Again, draw $o\ u$ parallel to W c, meeting c R produced in u, and complete the parallelogram $u\ o\ c\ z$; then $u\ c$ represents the pressure on the roller, and $c\ z$ on the pallet staff pivots.

But further, in the ordinary roller $m\ n$, the arc of intersection is much less than in the latter, while the pressure is much greater, and hence the advantage of the double roller is beyond question.

METHOD OF CONSTRUCTION.

Draw a circle of which A B (Fig. 68) is a section, and W its centre, and mark off 15 divisions indicating the points of teeth, represented by $a\ a'\ a''\ a'''$. Bisect the arc contained between $a''\ a'''$ in b, bisect the section of A B contained between $b\ a$, and draw W P. By the general mode, tangents would be drawn from a and b, and their point of intersection be taken as centre of the pallet, which would be p.† But after what we have shown, we will take a point as close to the arc A B as the stability of the pallet will admit, that point is P.

Draw P d, touching the point of tooth a, and mark off the angle d P f = 1° of locking + 2° of run, with P as centre, and P a as radius, cut f P in g. Make $\angle\ h\ g$ P = 80°. Again, bisect the arc contained between the teeth a and a' in S, and mark off the angle of drop C W o' = 2°.

Take a point c' in the line W e, through which A B cuts, and with P as centre, mark off m P = 11° = 1° of locking penetration, plus 10° of impulse.

With P as centre, and P C′ as radius, cut m P in o, join $g\ o$, and $g\ o$ will be the driving plane of the engaging pallet.

Also, draw P q touching point of tooth a''', and mark off the angle q P n = the angle of run = 2°, and the wheel angle of drop r W a''' = 2°, and $\angle\ n$ P s = 10°, bisect the arc $a''\ a'''$ in b. With radius P b, and centre P, cut P s in t, join $t\ x$, the point of intersection of W r and P n, and $t\ x$ is the driving plane of the disengaging pallet. Make $\angle\ s\ t$ P = 100°, and $t\ r$ will be the locking plane.

Draw $x\ x'$ and $o\ o'$ parallel to $t\ r$ and $g\ h$, and shape the pallet.

Draw the line of Lever and Roller centres P C at right-angles to P W. Make $\angle$ E P C = $\frac{1}{2}$ the pallet angle of motion = $\frac{1}{2}$ 10° + 1° + 4° = $\frac{1}{2}$ 15 = 7° 30.

Take a point D, in the line P E (the magnitude of P D must be decided by what has been shown in p. 152). Take $\frac{1}{3}$ of P D, and with D as centre, cut P C in C, then D will be the centre of the ruby-pin, D C the roller impulse radius, and $\angle$ D P C half the roller angle of contact.‡ This will represent the lever resting against the guard-pin M, and the lever notch requires to be short enough to allow the exit of the ruby-pin, and deep enough, so that this pin does not touch when in the line of centres P C. The guard-pin L has to be placed in the line P E, and as close to the notch as the stability or soundness of the hole, or notch, will permit, as will be gathered from Fig. 67. Draw the circumference Q R just free of the guard-pin L. The centre of the crescent is placed in the impulse radius C D produced, is made sufficiently deep so that the guard-pin does not make contact in the line of centres, and wide enough to admit its entry

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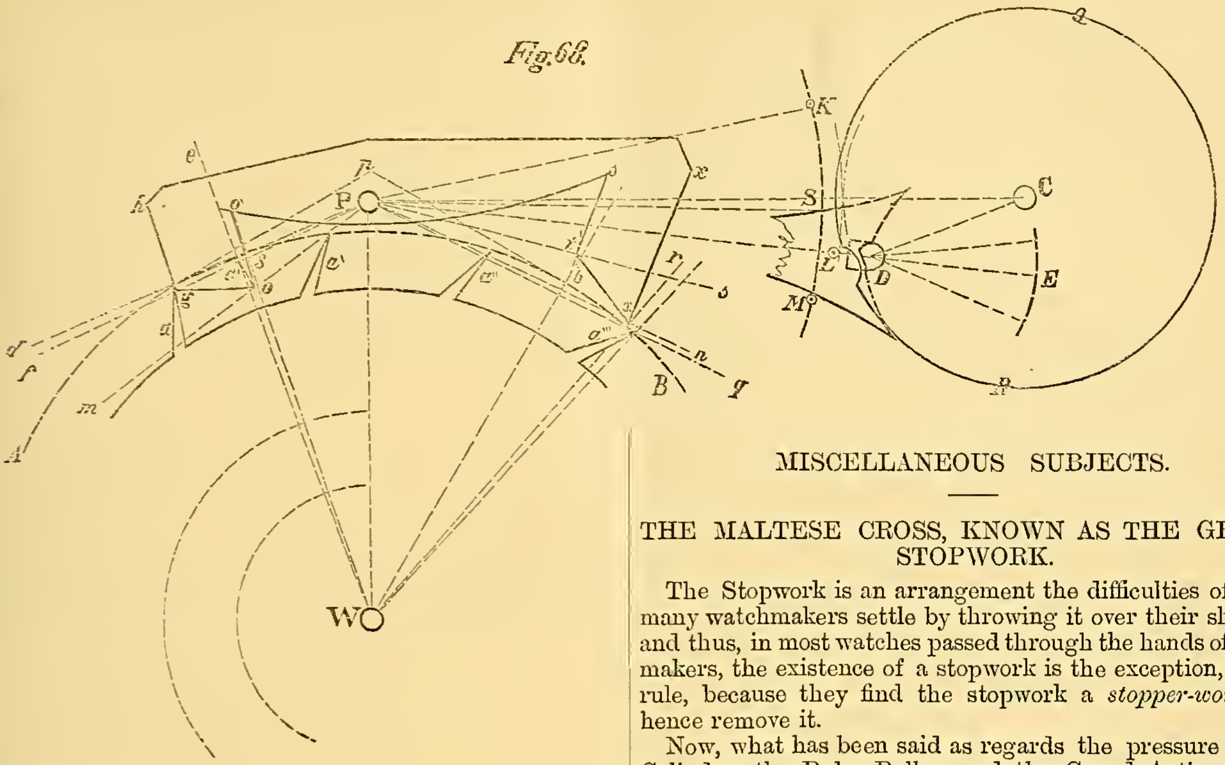
† This will give pallets with equidistant lockings. If circular pallets have to be drawn, then P W g must equal P W r.

‡ D C : D P : : line D P C : line D C P.

Fig. 68.



The opposite banking pin is placed so as to admit a lever motion of 15° = K P S.

The horns of the lever are drawn so that the ruby-pin is free of them in entering the notch, but no more than is necessary for clearance, which will ensure the relative angular positions of lever and roller, should the guard pin be faulty.

We have treated the Lever Escapement in its most simple form. There are many points connected with it, which would afford instruction and various modes, each one of which require separate treatment, and admit of extensive analysis, but we have not now the opportunity. We trust, however, that if the principles on which we have based our arguments are fully mastered, they will not only help to understand the Escapements we have treated, but many others in which they have their application.

In treating a "Contact before the Line of Centres" in wheels and pinions, it was said that the subject would be mentioned again in connection with contact across the line of centres in Escapement, as to the question, why it should be less objectionable in the latter than the former.

The Duplex Escapement is a fitting illustration of this. When the point of the pallet ploughs up the face of the teeth, we have the condition of pinion contact before the line of centres, and the destruction of the duplex teeth is a proof that the objection has a practical basis.

Again, in Escapements we have a soft point passing over a hard plane, whereas, in the other cases, it is just reversed; and lastly, the action in escapements is rapid and final, whereas in train it is a slow motion and a transmission of force. Other conditions have their points in the demonstrations of contacts that we have given.

MISCELLANEOUS SUBJECTS.

THE MALTESE CROSS, KNOWN AS THE GENEVA STOPWORK.

The Stopwork is an arrangement the difficulties of which many watchmakers settle by throwing it over their shoulder, and thus, in most watches passed through the hands of watchmakers, the existence of a stopwork is the exception, not the rule, because they find the stopwork a *stopper-work*, and hence remove it.

Now, what has been said as regards the pressure on the Cylinder, the Ruby Roller, and the Guard Action in the Lever Escapement, applies here; that is, in proportion as the circumferential force of the stop-finger, which is proportionate to the winding force, is resolved, we have a tendency to have the finger and star, or cross stop, forced asunder, or crushed, and hence derangement introduced.

Let S and F, Fig. 69, be the centres of the cross and finger-stop of a stopwork, and S *a* and F *a* their respective radii of contact. Let *b a* represent the magnitude and direction of the circumferential force of the finger-stop. Draw *b r* parallel to *a* F, meeting *a* S produced in *r*, and complete the parallelogram *r a b m*, then *a r* represents the pressure on the circumference of the cross, and also on its centre, and *b m* on the finger-stop. We see, again, from this, that as ∠ S *a* F approximates to 90°, *r a* becomes equal to *b a*, and therefore the pressure is at a minimum. It always happens that any increase in the shake on the

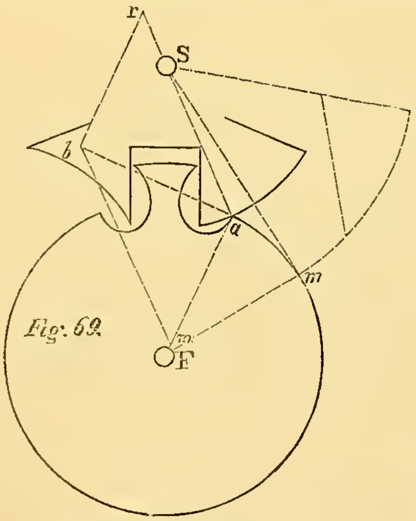


Fig. 69.

centre of motions increase $\angle S a F$, and with it $a r$, which therefore becomes a factor in the disorder.

It is a matter of experience, that the stopwork we see in an old watch, where two-toothed wheels are applied, each one carrying fingers, there is hardly ever any error. This may be explained by the fact, that the contact is more tangentical; and, being made at a greater radius, the circumferential force at the point of contact is less. This good quality of the latter could be united with the Maltese cross stopwork, but we should have a sacrifice of barrel depth, since it clearly requires more room; S m F would then be a right angle.

THE DOUZIEME GAUGE.

We know that the Douzième Gauge is used to gauge the ratios of the thicknesses of substance, which cannot be otherwise determined. Now, there is a geometrical property of this gauge, which we desire to make ourselves acquainted with: Suppose the arc contained between the long arms is divided equally according to the general divisions of circles, then it is a fact, that a substance which measures double the number of degrees, would not be double the thickness.

Let A C B (Fig. 70), be an angle of 60°, let C B equal 1, that is, one inch or one foot, and divide the arc A B in four equal parts, A c, c b, b a, and a B respectively; then each angular measure = 15°. Join B a, B b, B c, and B A.

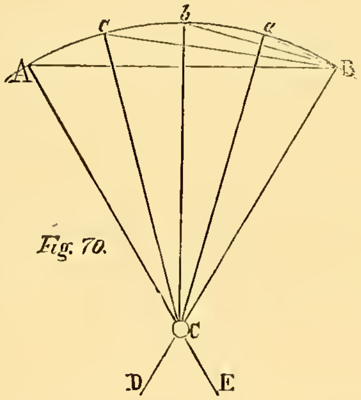


Fig. 70.

Now, it will be found, on construction that the chord B a = ·26, chord B b = ·5176, chord B c = ·765, and chord B A = 1.

But 26 × 4 = 1·04, which makes an error of ·05. Therefore, it follows, that in forming a Douzième Gauge, we have to proceed in an inverted manner; that is, set out the chords, so that B b = 2 B a, that B c = 3 B a, and B A = 4 B a, and then divide the arc A B into any number of degrees we choose. Since the opening D C E is always in ratio of the opening A C B, we then get the result, and any substance, which is indicated by the chord a C B, is exactly the $\frac{1}{4}$ of another, which is indicated by the chord A C B.

THE SECTOR.

The well-known instrument called, by watchmakers, "Sector," rests on this principle: We have stated, or shown, that in wheels and pinions, their radii or diameter are in ratio of their numbers, and likewise it is a fact, that in constant angle the chords vary as the radii. We use the latter as a principle or measure for determining the relations of diameters in wheels and pinions.

Let A C B (Fig. 71), represent a Sector, and chord A B the diameter of a wheel. We know the radius of the wheel: radius of the pinion, as the number of the teeth of the wheel: the number of bows in the pinions. Suppose we have a wheel of 60 teeth, and wish to know the diameter of a pinion of C. Then, 60 : C : : A C : a c.

Then, a b will represent the diameter.

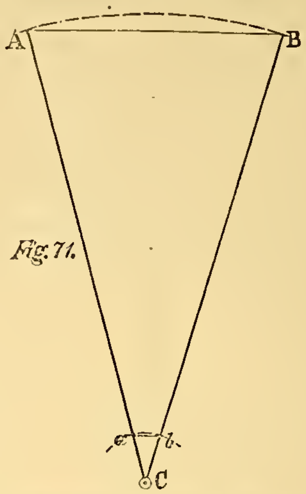


Fig. 71.

According to this principle, the arms are graduated; so we have always the ratios of C a to C A, as the number of leaves in the pinions, to the number of teeth in the wheel.

Repairing Swiss Watches.

By Hy. Ganney.

(*Continued from page* 140.)

No. XIV.

THE ruby-pin having many various sizes and proportions, some consideration of its peculiarities are necessary as opposite opinions are prevalent as to its size. When made as small as possible, we have the unlocking action performed with the greatest amount of friction as the pin is acting in a narrow notch which is before the line of centres of the pallets and balance axis, and the application of oil to the small pin is desirable to diminish the friction. When a wide ruby-pin and large notch is used, the side of the notch which does the unlocking may be at the centre, and oil is not necessary. The wide ruby-pin, though easing the unlocking resistance, has increased friction on the impulse, because the propelling edge of the lever is as much on the wrong side of the line of centres, as the unlocking is on the right of it, and this is considered by many to balance the advantages and disadvantages of large and small roller pins. The curtailment of the arc of vibration is also a disadvantage, as a wide notch and pin prevent as large an extension of the balance as can be obtained without striking the back of the lever, as is allowable when pin and notch are of smallest dimensions; but the desirability of facilitating the unlocking is, in my opinion, very great, as the impulse is only a diminution of a powerful and active agent already in operation, whilst the friction on the unlocking constitutes obstacle to the freedom of the balance vibrations, and retards the vigour and celerity with which the escapement should commence its work of propelling the balance, whose vibrations are impeded less by an easy unlocking and slightly diminished propulsive force, than by a slow and heavy unlocking, succeeded by a more vigorous propulsion, both being elements of disturbance and inimical to good timekeeping. The round pin with flattened front, or, when large, the triangular pin, is best, but the oval pin being common and popular is a very good form for general purposes, and is that most used in Swiss levers, in which ruby-pins are usually, and with good reason, larger than in English work. The usual way to fit a ruby-pin is to place the pin in the hole as tight as possible and quite upright, powder some shellac and place a small portion on the back of the pin; then, putting the roller upon a piece of wire, the end of the wire is held in a flame and heated, the shellac is watched with the eye-glass until it melts and runs round the pin, when it is removed. Generally, jobbers leave too much shellac; it is not necessary that any shellac should be visible; if it has run in the hole properly a small portion of the shellac will hold, but much shellac will break or shake off when the watch is going. Some use liquid shellac, made by dissolving shellac in alcohol; the alcohol evaporates and leaves the shellac; others recommend some of the spirit varnishes. Anything that will stick and not injure steel or oil, or be affected by them, will do the job, it seems.

Considerable alterations of a bad escapement may be made by altering the pin to stand deep or shallow as may be desired, by warming the roller and pin on a piece of wire and moving it in the required direction, if the roller and lever are not too close at their acting parts. With a roller and lever only, free of each other, altering the inclination of the pin will have no effect on the part that is close to the roller, and placing them farther away must first be done before any effect can be obtained. Lever pallets being secured with shellac also, many alterations can be made by shifting the jewels which, though not desirable as a rule, may be resorted to when other means fail. In jobbing, the end justifies the means, and though it is quite true no alterations can be made with advantage if the work is of high class and originally correct, yet in common work, made without plan or principle, much can be done in the way of obtaining a performance by the initiated who have sufficient knowledge of the escapement to understand the effect of the alterations they make; otherwise, moving pallets is simply entering a maze of troubles without a clue out again. There are two sorts of watch jobbers, some who can do a little well, and others who can attempt a great deal and come out all right; and there is no finer field in the world for the display of courage and perseverance than watch work. Sudden *coups* and lucky hits often bring success in other walks of life; nothing of the sort is possible in this art, in which patience is an incalculable virtue. In Swiss levers it is observable that the angular motion of the escapement is usually much greater than in the English, 50 or 60 degrees of motion of the balance before the pin becomes detached; this allows of more latitude in the way of errors and their corrections than is to be had with low angle escapements, where only 30 degrees of motion includes the whole action of the escapement. Any error of side shake or disproportion of parts may prove fatal, and it is not proved that the highly detached escapement is a better timekeeper; the theoretical difficulties are diminished by higher detachment, but the practical difficulties are increased. More good English levers have gained high reputation with 15 degree pallets, than with those of 8 degrees of motion—a reaction, caused by practical experience, against the very highly detached lever. It is not necessary that the angle of action for the lever should be the same as for the duplex and chronometer, as the diminution of the angle of these escapements is necessary to prevent them setting on the impulse or unlocking, which is not the case with the lever, as the impulse is only a continuation of the unlocking action, and the escaping angle may be increased in proportion to the increased vigour and extent, without injuring the time-keeping qualities of the lever. The larger surfaces acted on allows of more accurate connection and working of the parts of the escapement.

(*To be continued.*)

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 151.)

"Save me from my friends."

THE ADVANTAGES OF A SOLID TOP PLATE CONSIDERED.

ABOUT twenty-five years ago, Mr. Guilliame, a celebrated watchmaker in Spencer Street, Clerkenwell, invented and adopted a solid pillar plate for fusee watches. It was at first received with marked opposition by all members of the trade; not only did the case and dial maker raise objections, but escapement makers and finishers declared there was more work (?) and demanded more pay; and when it was sent to be jewelled in the third and fourth wheels, the jeweller declared it was impossible to cement in the lathe such a heavy body of metal, and it was therefore impossible with existing appliances to jewel it, until at length a watch jeweller conceived the brilliant idea of holding the plate in the dogs of the mandril, and so surmounted the last difficulty in its manufacture. It was also denounced as heavy and deceptive. Mr. Guilliame is dead, but his invention has not died with him, and it seems destined yet to live a long life, for there is not a single watch manufacturer in England to-day who does not use a solid pillar plate for best key and keyless fusee watches. It is found that not having to turn out the back-plate, the absence of three bars, five screws, and six steady pins, diminishes the cost of the movement, and at the same time adds to its strength and durability, and also facilitates cleaning and repairing.

Such was the reception accorded to solid pillar plate work, and we are not warranted in expecting a better reception for a solid top plate; yet I shall be able to shew the advantages of a solid top plate to be manifold greater than a solid pillar plate.

1st. It does away with the pillars which, however carefully made and rivetted, or even screwed and rivetted, are always liable to work loose, especially if they are subjected to much heat in gilding. All prudent manufacturers have long since abandoned a brass edge, because the feet always worked loose; they were not able to bear the weight of the entire movement, and though a loose brass edge foot is a small matter compared with a loose pillar, its liability to loosen is sufficient cause to reject it, and it is retained only by a few Coventry manufacturers who make the very worst fusee watches that are made in the world; and the reason they assign for retaining it is, that it facilitates manufacture—which I fail to see. In lieu of pillars always liable to loosen, it is much better to turn solid supports on the top plate, which cannot give way.

2nd. A solid top plate admits of the escapement being made without bridges; even the pallet staff-bridge of a three-quarter-plate watch may be made on a solid top plate, which greatly strengthens one of the weakest parts and most frequent source of trouble in a watch. For example: in a Geneva lever bridge watch, how frequently imperfections in the escapement arise from defects in the making of the bridges, which could not happen in solid top plate work; to wit, a drunken screw (*i.e.*, a screw that wabbles from side to side when it is being screwed into the plate; it arises from the metal being forced obliquely into the screw plate, which does not cut the thread, but only presses it up; all screws made in a plate are more or less drunk) will often slightly shift the bridge and affect the depth of the wheel and pallets, that will cause the watch occasionally to stop and be a constant source of trouble. Like defects may arise from bad steady-pinning in the bridges; and though I do not assert it is impossible to make a sound bridge watch, yet I am prepared to prove that bridge work cannot be made price for price as sound as solid top plate work. It is very true that Switzerland turns out a bridge watch at a lower price than any other form of watch in the market, and she is heartily welcome, both to the profit and reputation she can make out of the rubbish that are sold in this country from ten to twenty shillings each.

3rd. A solid top plate offers advantages in protecting the smaller acting parts from dust, &c., and properly made, it will to some extent take the place of a cap. The small acting parts of a geneva bridge watch are so exposed as to render it useless to a working man who is employed in a place where dust and dirt is always fying about, and constantly getting into his watch pocket; for example, the fourth wheel is pivotted so close to the plate, and the freedom of the fourth and scape wheels is so small, that the smallest piece of dirt is sufficient to stop it. The fourth wheel being opposite to the joint, an unreasonably large hole is made in the case for the spur of the fly spring, which admits of a plentiful supply of small particles getting on the fourth wheel, which always find their way into the escape pinion. I suppose it is carried there by centrifugal force on a small scale. In some of the old geneva lever watches, and a few of the modern ones, the fourth wheel is placed above the scape wheel, which makes all the freedoms of train proportional, and avoids some of the bad effects described. American watchmakers have wisely adopted this arrangement.

4th. Dust pipes are indispensable in a key watch, and when properly screwed on the plate and fitted to the case, are expensive. The worst form of dust pipe is the one on the set hands square of a Waltham watch. It is so constructed that if it was made to touch the case it would press upon the centre pinion and stop the watch, or make it go irregularly; to avoid this, it is left with a freedom varying from $\frac{1}{16}$ to $\frac{1}{64}$ of an inch, which defeats the purpose for which it is designed, and it does not say much for interchangability. A solid top offers advantages in respect of dust. In a model sent to the office of this journal, I have shown one that can be made in a minute, and that is free from the objections referred to.

5th. It has frequently been urged upon the consideration of English watch manufacturers, that if they intend to retain their trade, they must not only make a cheap, sightly, and sound watch that will perform well, but it must also be one that can be easily and cheaply repaired. To this end, not only must care be taken to adopt recognised and well-established principles, but they must in all the essentials be efficiently carried out. The watch must be so made as to be easily put together, and when put together the depths of the train and the escapement must be so arranged that they can be easily examined. In the model referred to, care has been taken to secure these advantages. It may be examined, cleaned, and put together in three-quarters of an hour by a workman of average ability. There must be no overcrowding in one part of the watch and wasted space in another. Care must be taken to avoid errors of calliper. In short, the several parts of the movement must be arranged or disposed of, so as to serve and not defeat the purpose for which it is designed. I will now give a few examples of these faults. In an English lever watch recently made, one of the brass edge feet is planted so near to the fourth wheel, that when the pin projects through the foot it touches the wheel, and is more than sufficient to stop the watch. A second brass edge foot in the same watch was planted so near the great wheel that it was scarcely possible to avoid a collision with it. Pins in this part of a watch are a great nuisance, and screws badly fitted are a greater nuisance. In a balance cock planted too near to the fusee hole of a full-plate watch, the cock was screwed into the thin part of the top plate, turned out to free the fusee cap, having only one turn of thread to the cock-screw; the result was it overturned after being screwed in a few times. Plant the screw in the proper place and it will last for a century. It may be salutary occasionally to visit Madame Tussaud's Chamber of Horrors; but nobody could live there, neither will we dwell on errors of calliper.

RICHARD WHITTAKER.

(*To be continued.*)

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The Taxation of Silver Plate.

Contrary to general expectation, the abolition of the duty on silver plate has not been included in Mr. Gladstone's Budget. This means another year of suspense; another year of stagnation, and a further decline in the silver trade. It is true the Chancellor of the Exchequer is as emphatic as ever in condemnation of the duty. In his budget speech he says:—

"I will first mention a subject on which no change has been introduced into the law, though I have been desirous of doing so. I refer to the duty on silver plate, in support of the abolition of which there are two reasons. One reason is the great anxiety entertained by the Indian Government that the duty should, if possible, be removed, they believing it to be a serious hindrance to the introduction of silver goods from India. But the more general reason is that the duty perplexes the market very much, placing transactions in new plate and transactions in old plate on an embarrassing footing relatively to one another, and undoubtedly working mischief in the limitation of industry, and in lowering the standard of silver goods. When it is said, "Why not abolish the duty?" the formidable question of the drawback is raised. I am not prepared to propose a drawback on silver goods, and I doubt whether the trade is in a position sufficiently lively and progressive to enable it to meet the change without the drawback. The revenue derived from silver goods is from £50,000 to £60,000 a year, and the drawback would not be less than three or four times that amount. On the whole, I am inclined to believe that the consideration of drawback is not applicable to the subject at all, and I only advert to it because it may be understood in India that we are really desirous to make progress."

Now it is plain enough that if the trade had been "sufficiently lively and progressive," and suggested some mode of meeting the question of drawback, without putting too great a strain on the Exchequer, the duty on silver plate, which is rapidly killing the trade, would now be a thing of the past.

We warn the trade once more that the duty *must and will be abolished;* the agitation for its repeal will not cease, and we doubt whether a drawback will be obtainable at all; in fact, Mr. Gladstone thinks the right to it questionable. In the next Budget the Chancellor of the Exchequer will again have to deal with the question, and it is all but certain that the subject will be dealt with simply from an economic point of view, and without referring to the few obstructives who stand in the way of this vital reform. Why not put up with the loss at once, and seek compensation in the speedy and large increase of trade which is certain to follow? If there is any energy and sagacity left in the members of the silver trade, they will, with the least possible delay, interview Mr. Gladstone, boldly renounce the drawback, and thus enable him to perform his promise.

Correspondence.

EARLY CLOSING IN CLERKENWELL.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Will you allow us, through the medium of your journal, to inform the members of the watch, clock, and jewellery trades (especially those residing in the suburbs of London), that the establishments of the undermentioned Clerkenwell firms will, on and after Monday, 5th of June next, be closed at 7 o'clock p.m., instead of 8 o'clock as formerly.

The knowledge of this may save disappointment to many, as we think this list includes all the principal wholesale houses who do not already close at the earlier hour.

Yours, &c.,

2nd May, 1882. CLEMENTS, HANDLEY, & CO.

Berendt Bros., 6, St. John's Square.
Bladon, J., 16, Clerkenwell Road.
Clements, Handley, & Co., St. John's Square.
Davenport, A. J., & Co., 48, Clerkenwell Road.
Davenport, A. J., Junr., 27, Great Sutton Street.
Gray, E., & Son, Clerkenwell Green.
Greenhill, J. F. & S., 12, Great Sutton Street.
Grimshaw & Baxter, 35, Goswell Road,
Hannaford, F., & Son, 46, Clerkenwell Green.
Haswell, R., & Sons, 49, Spencer Street.
King, J. W., 15, St. John's Square.
Lowe, F., 26, Clerkenwell Road.
Millward, A., 12, Albemarle Street.
Pratt, John, & Son, 28, Clerkenwell Road.
Sanders, Thos., 24, Great Sutton Street.
Stockall, J. J., 6 & 8, Clerkenwell Road.
Whelan, C. J., 57, Great Sutton Street.

ANTIQUE CLOCKS.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Having seen a clock of somewhat rude construction, by Thomas Tompion, in the Guildhall Museum of the City of London—"one of his earlier efforts," it has occurred to me that it may be of interest to some of your readers to know that an eight-day clock, a very fine specimen of the workmanship of the "Father of English Watchmakers," may be seen at this address, still going and keeping admirable time. The owner will have much pleasure in showing it to any who may deem it worth their while to call for the purpose of seeing it.

Yours truly,

THOS. W. SMITH.

22, Chiswell Street, E.C.

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Improvements in Fusee Keyless Work.—The writer will be glad to communicate by letter, or otherwise, with persons interested in the above subject. He has lately met with some useful suggestions, which, if properly developed, would, in the writer's judgment, be attended with great advantage to our highest class fusee watches.

Conditions of Correspondence:—

1st.—A comprehensive knowledge of Fusee Keyless work.
2nd.—An undertaking not to divulge that which is imparted in confidence.
3rd.—After initiatory communication, correspondence to relate only to defects and improvements in Fusee Keyless work.

Letters addressed, F.K.W., care of the Editor of this Journal, 11, St. Bride Street, London, E.C., will receive prompt attention.

A Warning.

We give the following as a warning to watchmakers. On the 29th of March last, a young man of about twenty-two, smooth face, dressed like a clerk, called on a watch importer, having offices in the City of London, saying, "I come from Messrs. So-and-So (well-known watch material dealers of Hatton Garden); we have a customer waiting for a gold keyless, kindly let us have one or two on approval." The watch importer knew Messrs. So-and-So well, and relying on the truth of the young man's statement, let him have the two watches, value £16 18s., but had him followed to Messrs. So-and-So, into whose offices the young man returned.

Not satisfied with that, on the return of his traveller, our watch importer sent him to Messrs. So-and-So, and a member of that firm gave the traveller a hasty assurance that it was all right.

So far so good; but a fortnight later, on the watch importer's application for an answer respecting his two watches, he was surprised to discover that the whole affair was a fraud—that the watch material dealers did not know anything of the young man who had called in their name, and, moreover, could not even account for having told the traveller who called on them, that it was all right.

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Trade Recipes.

Many watchmakers make use of a knife when taking out the balance spring; a piece of rod steel, about two mm. thick and ten mm. long, filed on one side in the shape of a knife with corners rounded down is easier and better to manipulate.

To remove the lustrelessness of gilt clock-cases, dead silverwork, &c., dissolve one oz. of cyanide of potash in one quart pure water, empty it into a bottle, and label it "poison." If to be used, place the article into an earthen vessel, cover it over with the solution, and the lustreless appearance will be removed in five minutes. Preserve the fluid for future use.

To Bend Tempered Steel without danger of Breaking it.—It very frequently happens in watch repairing that it is desirable to bend a spring, but the workman fears that the risk of breaking it would be too great, and therefore does not attempt it. In such a case, the following hint may be useful: Suppose it is desirable to bend the side click and spring of a geneva bridge watch, which, by the way, is generally made of very bad steel: lay hold of the end in which the screw goes with a pair of brass-nosed sliding tongs, holding it in the left hand; then press a piece of brass against the click, bending it in the direction desired, and, at the same time, holding it over the flame of a spirit lamp until the centre, or spring part, becomes a straw or dark-red blue colour, and this will have the desired effect. The fact that spring-tempered steel is brought to a dark-red blue twenty times over, will not reduce it below spring temper; it will tend to equalise and improve the temper and render it less liable to break. Again, suppose a cylinder pivot is bent, and you wish to straighten it by this process: Take a small bouchong, fit it to the pivot, and hold it over the flame of the lamp, bending it at the same time in the desired direction. For other purposes of a similar character the reader will doubtless exercise his own ingenuity.—R. W.

Trade Notes.

SOME interesting experiments were made at Ludgate Hill Station with Mr. C. E. Parker-Rhodes's system for the improvement of railway clocks. The system is entirely new, and was supplied to a clock erected by Messrs. Stephens and Woodman, of Brixton. Outside the dial there is a circle of twelve lenses, being one at each hour, and the minute hand (with a red disc) revolves over each lens every five minutes, and, in so doing, the exact minute to or after the hour is easily discernible. The hour hand (with a green disc) revolves over the figures within the dial proper, and, by its distinct colour from the minute hand, can at a glance be easily distinguished. The advantages claimed by Mr. Parker-Rhodes's system is that by day the light on the lenses renders them conspicuous, that the minute disc is at once observable, and that the dial has the advantage of their reflection of light within the chamber, which adds to the clearness of the dial and the position of the hour hand. By night, a jet of gas, magnified ten or fifteen times, as required, suffices to illuminate the circle of lenses and the minute hand, and, at the same time, by means of improved reflectors, the light is concentrated to the centre of the dial, thus giving over the whole surface an equal illumination of the hour hand. The experiments were very successful, and there is every probability of the system being largely adopted.

At the last quarterly Court of the Clockmakers' Company, held at the Guildhall, the Honorary Freedom and Livery was conferred upon the Astronomer-Royal, Mr. W. H. M. Christie, M.A., F.R.S., F.R.A.S. The Master, in an appropriate address, welcomed the new member, dwelling upon the close connection which existed between clockmakers and astronomers, and at the same time reminding the members that that was not the first occasion on which a gentleman holding the distinguished position Mr. Christie did had been enrolled, the late Mr. J. Pond having been admitted many years ago. Mr. Christie, in response, referred to the subject of the Greenwich trials, and expressed a hope that the prizes which the Company offered in connection therewith would stimulate the trade to further exertions; adding, that the exhibits of last year were of exceptional merit. After the usual ceremonial, the Astronomer-Royal was clothed with the Livery, and presented by the Master with a copy of Mr. W. H. Overall's "History of the Clockmakers' Company." Before separating, the Court unanimously passed a resolution in which they expressed the profound regret with which they had received intelligence of the decease of Mr. John Grant, the father of the Company, after an active and honoured connection with it extending over the exceptionally lengthened period of 65 years, during 55 of which he had been a member of this Court, having five times filled the office of Master.

At the annual meeting of the shareholders of Joseph Rodgers and Sons (limited), Cutlery Works, Norfolk Street, Sheffield, the usual dividend of 17½ per cent. was declared, and the retiring directors, Mr. William Watson and Mr. Frederick Bardwell, were re-elected.

The eighth annual report of Messrs. John Round and Son (limited), Sheffield, has been issued, and states the nett profit for the year to be £3,275, which, with the balance of £177 from the previous year, will make £3,452 available for dividend. The directors recommend that of this sum £3,125 be appropriated to the payment of a dividend of 12s. 6d. per share on the 5,000 shares of the company, being at the rate of 12½ per cent. per annum, and that the balance of £327 be carried forward to next year.

According to the official mining returns of the colony of Victoria, the amount of gold obtained in Victorian gold fields amounts to 858,146 oz. for the year 1881.

Under the new tariff introduced into the Austrian Parliament, gold and silver wares are in future to pay 300 florins instead of 200.

When her Majesty conferred the Order of the Garter upon the Earl of Beaconsfield, Sir Richard Wallace presented the noble Earl with the magnificent diamond star of the Garter originally belonging to the late Marquis of Hertford. After the Earl's death the star was sold by the executors to a firm of goldsmiths and jewellers. After having retained it for some months in the hope of disposing of it, but failing to do so, the latter have taken out all the diamonds—390 stones—and remounted them into single stone and gem rings of different sizes, so that the many friends and admirers of the deceased statesman might have the opportunity of obtaining a valuable memento. An earl's coronet and the word "Beaconsfield" are engraved inside each ring. It was asserted that the above star was presented to the late Earl of Beaconsfield as an heirloom, but the statement was incorrect.

At the Royal Institution on Friday, the 24th ult., Mr. Chubb (Messrs. Chubb & Son, 128, Queen Victoria Street) exhibited, in action, and explained the new patent electric time lock—one of the most marvellous, yet simple, pieces of mechanism ever invented. There is a duplex chronometer arrangement, so constructed that the lock can be set at anytime during one day to open at a given hour on the day following; or, if desired, can be set to remain locked over a Sunday or a holiday.

Edgar Ede, 25, a journeyman watchmaker, was charged at Worship Street with stealing a number of watches belonging to his employers, Messrs. Orton & Sons, watchmakers, &c., of High Street, Whitechapel. It appeared from the evidence of an assistant, that the prisoner was employed as a repairer off the premises, and on March the 25th he absconded, and nine watches belonging to customers of the firm, which he had in his possession, were missing. He was sentenced to three months' hard labour.

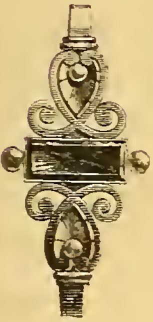
The twenty-ninth annual meeting of the donors and subscribers to the Clock and Watchmakers' Asylum was held at the Foresters' Hall, Clerkenwell. Mr. R. W. Cole, chairman of the asylum, presided, and in moving the adoption of the report, expressed the pleasure he felt in informing them that the state of affairs during the past year was, on the whole, very satisfactory, the balance-sheet showing that the donations and subscriptions exceeded those of the previous year. Mr. J. J. Stockall seconded the resolution, which was carried. Mr. George Moore was re-elected treasurer, and the retiring members of the committee, and other office-bearers, were re-appointed. Mr. J. Stevens and Mrs. M'Cormick were entitled to the benefits of the institution by a majority of votes.

Mr. J. U. Poole read a paper on the Marine Chronometer in the Lecture Room of the Agricultural Hall, during the Naval and Submarine Engineering Exhibition.

The Half-Yearly General Meeting of the Watch and Clockmakers' Pension Society was held at the Horological Institute, on Monday, the 24th ult. Mr. J. T. Newman occupied the chair. Mr. J. U. Poole was unanimously elected as Treasurer of the Society, and Mr. Shepherd as Vice-President. A ballot was taken for the election of a female annuitant, which resulted in favour of Mrs. Fawson, with 700 votes.

Supplement to the Watchmaker, Jeweller, and Silversmith, June 5th, 1882.

MONTHLY SUPPLEMENT OF DESIGNS.



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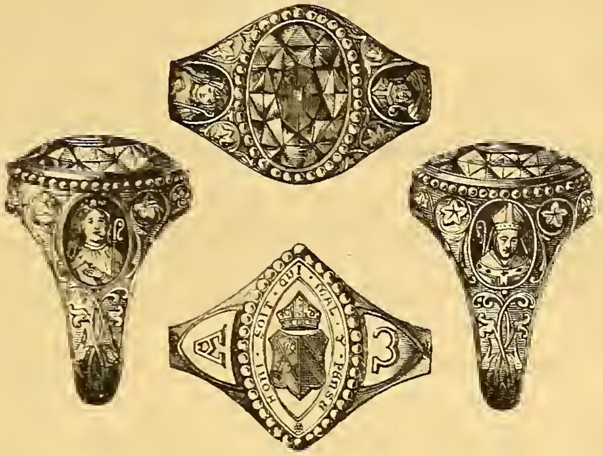

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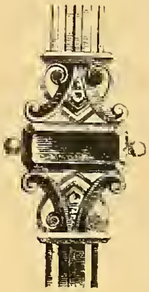

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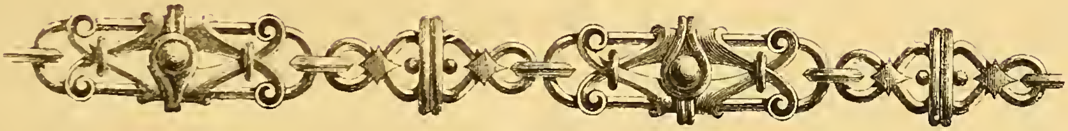

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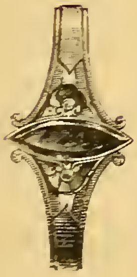

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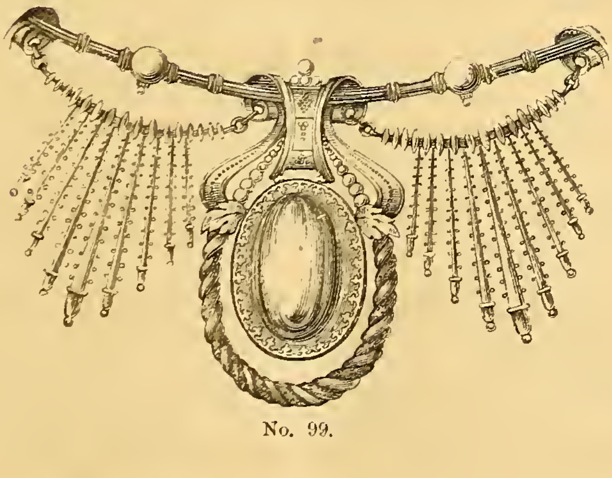

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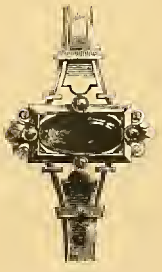

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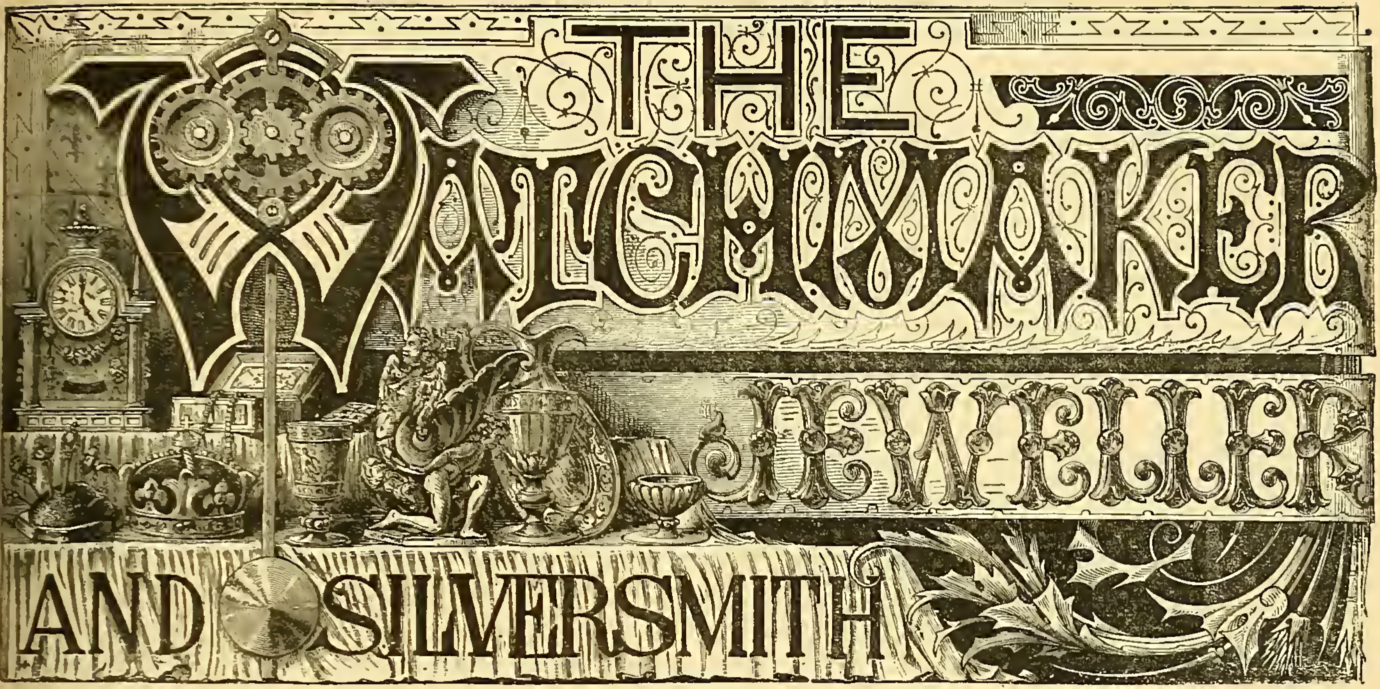

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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TWO ILLUSTRATED SUPPLEMENTS:—1. Designs for Modern Jewellery. 2. Antique Rings and Ornaments.

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The Future of the English Watch Trade.

By James U. Poole.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—I was prevented from giving my attention to the further consideration of the above subject last month, in consequence of the interruption caused by the Naval and Submarine Engineering Exhibition; but I am pleased that the necessity of an apology to your readers has been removed, by the publication of the interesting contribution of Mr. Ganney, who is able to speak from personal experience of matters, concerning which my information is very limited. His advice, however, about not wasting time or money in visiting America in order to make up my mind as to the advantages of machinery and the factory system is superfluous, as those who know me best are fully aware that I am not in the habit of wasting either one or the other, and a visit to the States would be in response to the friendly invitation of old correspondents, who have undertaken to "shew me round."

He is, moreover, scarcely correct in saying that I am *opposed* to machinery and the factory system. It is true that I regarded the introduction of the latter especially with very great reluctance, but in the same spirit I regret the manner in which our beautiful line of battle ships and frigates of the old type have been replaced by such uncouth monsters as the Devastation and Thunderer; so that having to submit to the inevitable in one case, may pave the way for an equal change in the other. It is rather singular, however, that a Coventry trade journal last month contained a graphic description of the social disadvantages connected with the outdoor employment of young people of both sexes, but we might perhaps be able to manage matters better in London. I also fail to see how the system would benefit our present class of middle-aged and elderly workmen, and for this reason I have endeavoured to make a very strong distinction between the class of work which I imagine would be turned out from a factory, and the watches made on the regular Clerkenwell system.

Mr. Ganney speaks of co-operation, and I am not prepared to enter into the discussion of that subject, to which I have really given no attention. The "opposition" that he says I gave to the introduction of a certain watch, some twelve years ago, was based upon surmises which subsequent information has convinced me were perfectly correct, and in time to come I shall not hesitate in using any influence I might possess to oppose any scheme or project that appeared fallacious.

Still, on the whole, I thank Mr. Ganney for the tone of his criticisms, which are far more courteous than some to which I have been lately subjected, and he appears to understand and allow for the powerful restraining influence of daily associations, and an education strictly based on the old system. Candidly, Sir, I do not see clearly how any change is to be brought about. I have been told that capitalists are ready to make the experiment if they could only be assured that there would be no combined effort on the part of the "trade" to crush the undertaking; and at one of the Social Science Congress Meetings, held at Edinburgh in October, 1880, I was told that a gentleman was then in the room who was prepared to put down £100,000 if there was a probability of carrying the matter through to a successful issue, but until someone *does* come forward I see no chance of any practical good coming of this discussion; for as Mr. Ganney truly says, the capital required for a new undertaking is too large for any one individual in the trade to control or risk safely.

During the progress of the late exhibition I had several opportunities of conversing with gentlemen of position on the subject of the watch trade, and there is no doubt but that the subject of watchmaking by machinery, as practised in America, has thoroughly laid hold of the public mind, which, indeed, is not to be wondered at, seeing that machinery is so largely employed in every branch of manufacture. One gentleman was wearing a very fine watch, expressly made for him by Mr. Kullberg, and he appeared quite able to appreciate the various artistic details of its construction; but he, nevertheless, maintained that our system was a bad one, and that one man should concentrate his attention on a special branch. This particular watch was required to be adjusted to a great nicety, and he said he waited two years for it, a time which I can certify is not unreasonable for one of the same construction, although it is quite prohibitory to ordinary customers, who will seldom wait longer than three months. He seemed to think that an American watch would have been timed much quicker, and spoke very highly of the performance of some of their lower grades which he had had occasion to purchase, I imagine for use on board his ships. Now I cannot admit that the same satisfaction would not have been given by English watches, but as an intelligent and educated man he was prepossessed in favour of an intelligible *system*, and it is for that reason I have given the full details of our intercourse. Another gentleman showed me an American watch, which, to prevent possible misunderstanding, I will say had *no* name on, which he assured me had only varied five seconds in twelve months. As he also informed me that he was a Major in the Royal Artillery, and as I held a commission in the Reserve Forces for a sufficiently long term of years to conceive a profound respect for the rank he represented, I refrained from any expression of incredulity, and only congratulated him on his good fortune. He said that he had been stationed at Malta for part of that period, but that he never altered the watch to suit local time. It had the appearance of being a Swiss chronograph in a very ugly case, with a dial each side. On three different occasions he came and triumphantly compared it with Greenwich Mean Time, as shown by a marine chronometer, but on a fourth it was twenty seconds out, and next time it had varied nothing, showing that its marvellous performance was due to a combination of favourable chances; and yet there is no doubt but that the tales of the excellence of the Major's "American watch" [made by machinery] would have considerable influence in the regiment.

Some London "makers" and "sellers" continually advertise the remarkable performance of a certain watch or watches, but these testimonials do not go down with the public as formerly, who regard the whole thing with distrust; and Mr. Ganney is right in saying that there are many people with money who do not know where to go for a reliable watch, and stave the matter off by getting a cheap one. There is scarcely a month now passes over without some important change taking place among old established retail houses, shewing that the watch business is very much changing its character; and most of those who remain seem to rely more on the sale of plate and jewellery, which is always fatal to the practical element, for the watch jobber is felt to be out of keeping with the glittering surroundings, and is either banished upstairs or removed from the premises altogether, to be replaced by the more courtly-mannered and better dressed salesman, whose business it is to endeavour to delude customers into the belief that everything is manufactured "on the premises," or else at the workshops of the firm. The public declining to be deluded, don't buy expensive watches; hence much of the present depression.

I now feel, Sir, that the topic has been introduced to the full extent of my ability; undoubtedly Mr. Ganney is right in prominently bringing forward the claims and influence of the workmen, and few are more fitted to deal with them than he is. Should he succeed in obtaining only a quarter of the amount he specified, the management of it will require the administrative ability of several heads of departments, and in the meantime we must wait for the good time that is supposed to be coming. Most of our best-known manufacturers have laid by a sufficient provision for their old age, and are not disposed to be put out of their way. The prevailing feeling is, it will last *my* time and "*après moi le deluge*". It is not, therefore, to be expected that any scheme for the manufacture of low-priced watches on a large scale will ever receive the support of the trade as a whole. The various businesses are working in their own special grooves, and will continue to do so until they successively go off the rails, as far as manufacturing is concerned; but on the other hand, as I hinted in my last paper, the former opposition is not likely to be repeated. Firms who thirty-five years ago subscribed to the fund for extinguishing the British Watchmaking Company, are now either extinct or else are carrying foreign watches to their customers in the country.

There is one other topic I desire to refer to before closing, and that is with regard to the British Horological Institute and its relation to the matter in hand, as it would seem at first sight that any action should emanate from that quarter; but the fact is, that the Institute, by its constitution, is precluded from dealing with commercial matters, and its leaders have always deprecated the slightest move in that direction; therefore, the manufacturing interest is practically without organisation or representation. As a proof of this, I need only refer to the nature of the work done by the pupils at the classes conducted under the auspices of the City and Guilds Institute. It might not be unreasonable to suppose that frames of an improved and uniform calliper would be served out to them; but as a matter of fact, each one brings his own frame and practically does what he likes. This arrangement was felt to be inevitable, and I only mention it now in order to show that the "system" on which the public lay so much stress is not at present being developed at the Institute. I may say, that as one of the Judges for the prizes offered to the members of the evening class for escapement making, I am mainly responsible for the wording of the resolution requiring each competitor to produce a balance staff and roller to *given sizes*, thus endeavouring to provide against careless working; but, unfortunately, as they will not be made to frames, the work can only be preserved as specimens.

The idea of the promoters of these classes is a very laudable one, viz., that the sons of retail watchmakers may enjoy the advantages of superior training, in order that they may subsequently appreciate the merits of good work and endeavour to sell it, and also that any imperfectly trained workman may have an opportunity of improving himself.

I believe that no one who is actually pursuing the branches of escapement making or finishing for a living has passed through the course of instruction, and I therefore regard the Horological Institute as a sort of college, where degrees may be awarded to deserving students, but as having no power to take a leading position in the establishment of a watch factory, unless, indeed, it could afford to do without the support of many of its present subscribers. With the foregoing remarks relating to the Institute, which I felt to be advisable, I now propose to bring the present series of articles on the Future of the English Watch Trade to a close; only adding, that I should feel bound to aid any well-defined *bona fide* scheme to the best of my ability. Certain it is that we should not have, like the Americans, to *make* our reputation as watchmakers for the world, but our task would be to *regain* a position of which we have *temporarily* been deprived. In military matters, the attacking force is always considered to have the advantage, more especially when it acts on its own ground.

Regal Difficulties.

CHARLES I., in the very first year of his reign, went over the contents of the Jewel House to see what would be available to pledge for money, consigning them to the charge of his favourite, Buckingham, about to proceed as ambassador to the Hague, for that purpose. In vain did Sir Henry Mildmay, the master of the Jewel House, suggest the advisability of the king taking the advice of his Council on the matter, and with their concurrence, using a warrant under the Great Seal, authorizing the pledging of the royal treasures, on the ground that there were too many, both in the court and the kingdom, who looked upon the duke's proceedings "with more than a curious eye"; in vain did Lord Brooke, who had some of the crown jewels in his possession, throw difficulties in the way, and complain of having to deliver up such valuables without a proper warrant. The king was determined on having his own way, and, before long, Mildmay wrote he had sent all the jewels and gold plate in his care, and if the king wanted anything more, he must be contented with silver plate, as there was nothing else left in the Jewel House.

On the arrival of Buckingham at the Hague,[*] he commissioned a Mr. Sackville Crow and one Philip Calandrani to raise three hundred thousand pounds upon two parcels of jewels, and one parcel of gold plate set with stones. The Hollanders, however, required a guarantee from some merchants of standing that the jewels should be redeemed within three years. After four months of negotiation difficulties were renewed, and rumours of quarrels between Charles and the Commons caused the Dutch usurers to express great doubt on the king's power to pawn his jewels without the consent of his parliament, and Crow finally returned to England with the greater part of his precious charge. Crow's fellow-agent seems to have been more successful, having managed to raise fifty-eight thousand pounds upon certain jewels. In 1628, a warrant was issued for the payment of three thousand pounds for interest on the above-named sum; but twelve months later, Calandrani writes to Secretary Dorchester that his brother has written to him from Holland "that those who have the pearls in hand," and also the Widow Thibaut, who has his majesty's jewel of the "Three Brethren," will not wait any longer, but proceed to execution before March, and begs the secretary to prevent the damage and dishonour which will be caused by delay in redeeming the pledges. Upon this Charles took the affair in hand himself, and sent out instructions to sell four thousand tons of iron ordnance to the States General for one hundred and twenty thousand pounds. With this sum the plate and jewels pledged in Holland, and "the collar and rich ballasses" pawned to the King of Denmark, were to be redeemed. But the jewels did not find their way to the Jewel House, and through the roguery of parties concerned, much spoliation occurred. In 1629 Charles took away from the secret Jewel House a fine large agate, engraven with the portraits of Henry VIII. and Edward VI., and at the same time ordered the sale of sundry articles of more or less value. Among these discarded ornaments were twelve pieces of goldsmith's work, like friar's knots, with ninety-one pendant pearls, being part of a collar of gold; two great half-round pearls taken from the "Mirror of Britain"; four gold collars, including that of the order of St. Michael, composed of twenty-four knots of gold, and twenty-four scallop-shells, with the saint hanging to it by a couple of little chains, also a gold lorayne, or double cross, set with diamonds and rubies; an old jewel in the shape of the letter M; a circlet of gold "new made for our dear mother, Queen Anne, having in the midst eight fair diamonds, eight fair rubies, eight emeralds, and eight sapphires, and garnished with thirty-two small diamonds, thirty-six small rubies, and sixty-four pearls, and on each border thirty-two diamonds and rubies; and a girdle of rubies in the form of red and white roses. A year after his sale Charles accepted £1108 from James Maxwell, and in consideration for that sum, authorizing him to retain as his own property two large diamonds upon which he had previously advanced £11,346.

While all this pawning and selling were going on, Charles patronised the jewellers as liberally as though the royal exchequer was overflowing with riches. In the very year that his agents were bringing England into contempt abroad by carrying her crown jewels from money-lender to money-lender, the king added to the royal collection a diamond costing eight thousand pounds, a gold ring of four hundred pounds, a fair jewel set with diamonds, worth nine thousand five hundred pounds, and a looking-glass set with diamonds, priced at two thousand five hundred pounds. He purchased three thousand pounds' worth of jewellery for the Queen from Mercadet, and when the jeweller presented the order for the money, he was informed that the exchequer had not the wherewithall to satisfy his demands, and was compelled to give it some months' credit. John Vaulier, who supplied the king about the same time with about two thousand pounds' worth, is found, after eighteen years of constant dunning, still without his money, while Sir Thomas Roe, after patiently awaiting for three years and a-half, complained bitterly that he saw no prospect of obtaining two thousand five hundred pounds, for some jewels he had procured at the express desire of the queen, and for which he had actually paid three thousand pounds.—*Jones*, "*Precious Stones.*"

Mr. Joseph Andrews has been appointed receiver of the estates of Mr. E. L. Miroy, clock and bronze manufacturer and importer, carrying on business in Queen Victoria Street, under the style of "Ernest Miroy and Co." The debts are £6,000.

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[*] In the "Antiquarian Repertory" is "an account of the vastly rich cloaths of the Duke of Buckingham; the number of his servants, and of the noble personages in his train, when he went to Paris, A.D. 1625, to bring over Queen Henrietta Maria. His grace hath for his body twenty-seven rich suits, embroidered and laced with silk and silver plushes; besides one rich-white satin uncut velvet, set *all* over both suit and cloak with diamonds, the value whereof is thought to be fourscore thousand pounds, besides a feather made with great diamonds, with sword, girdle, hatband, and spurs, with diamonds, which suit his grace intends to enter Paris with. Another rich suit of purple satin, embroidered all over with rich orient pearls, the cloak made after the Spanish fashion, with all things suitable, the value whereof will be twenty thousand pounds, and this is thought shall be for the wedding-day at Paris. His other suits are all as rich as invention can frame, or art fashion."

The Worthies of Horology.

By C. Stuart Murray.

II.

I CONCLUDED my first paper by saying that in this one we should all go into the classic world. Well, so we will, and when we have gone through it, we shall find that the sun of horological science has begun to dawn upon us. And it is somewhat remarkable how, in our journeying in those ancient ways of practical mechanism, we are apt to stumble against something that we thought had only been invented in modern times. The Clepsydra—literally, water-stealer—had its "day" co-eval with the sun-dial, and may be understood to have been the indoor timekeeper of the period. We are, I am sorry to say, with respect to its origin, in the same ignorant position as with that of its out-door co-worker the sun-dial, and that is disappointing. "Who invented the Clepsydra?" has been asked at any time in history during the last two thousand years; but, the same invariable hungry answer comes back to us like a question-echo—"Ah, who indeed?" The names that have been invoked for information by thirsty souls of knowledge are as learned as those who created the Heathen Mythology. Alas, the answers only glide us more and more centuries backwards into the "darkness visible" of the dead and by-gone ages! Vitruvius, the architect, who lived about a hundred years before Christ, and to whom we are indebted for the model that will be described hereafter, gives the credit to Ctesibius, of Alexandria. That it might not be allowed to stand to the good of the great Alexandrian, did not not others farther off call "mine" to it; and, woful to say, in the dim distance beyond them all is to be seen the ever-appearing John Chinaman. Not that John invented the absolute "water-stealer," but that his quicksilver puppets have had such antiquity claimed for them, which I cannot stop to inquire into, as to have created the idea that lead to the construction of the other instrument. It is, I believe, generally conceded, that whoever was before Ctesibius, used a very different kind of instrument to that with which his name is associated.

Upon consulting such authorities as are within my reach, I find that the Chaldeans must again be mentioned. It is said that their division of the Zodiac into twelve parts was done by means of a water-measure that held enough to drip during the whole revolution of a star. As each twelfth part of the water escaped through the orifice of the water-measure, so they concluded that one Zodiacal sign had gone over the horizon. We are told that Demosthenes and Cicero make frequent mention of clepsydras being in public places; the former before the time of Ctesibius. In the courts of law, and assemblies of the people, the authorities provided each orator with a clepsydra. From that practice resulted the expressions as to how business was proceeding; namely, "They are still at the first, or at the second, or at the third water." Translated into—"The plaintiff's case is finished;" or, "The evidence is closed;" or, "The judge is summing up," &c. Again, if one speaker went beyond his "drops," he was instantly met with the cry of "You encroach upon my water;" "You are stealing from my clepsydra," &c., &c.

I will now mention some of the shapes of these water-clocks. Let any person take a large straight syringe and fill it with clean water, fix it so that it will have the nose downwards and the wide part upwards, the piston of course being removed. If the hole at the nose—*orifice*, I believe, is the learned term,—be small and clear, then the water will drip into whatever may be placed under to receive it; this dripping will continue until the syringe is emptied. Consequently, whilst the operation has been going on, a certain portion of time has passed. Now, as there must have been some common standard for the whole day, such as so many hours of the sun, or of a star, it followed that each clepsydra indicated approximately a fractional part of that standard. In order to show what that fractional part represented, the vessel that received the fallen water was marked on the inside, and had a float belonging to it. As the water rose, the float rose also, and indicated the length of time the clepsydra had been "going." It has been said that this form suggested the use of sand-glasses for a similar purpose.

The great difficulty with respect to keeping clepsydras well "upon time," was the counteraction of the disturbing causes. These causes being the temperature of the surrounding atmosphere, the character of the water as to its purity, the maintenance of the fluid level, and the freedom from either obstruction, by water impurities, or wear of the drip-vent. To keep all these in order comprised very nearly our modern work of compensation and adjustment. If the temperature rose, that would change the height of the water column, whilst if it fell it would lower it, thereby affecting the pressure on the outlet. This would be the changing of the level by the action of the temperature; but another disturbance of level has to be taken into account—that is, the disturbance that is caused by the irregularity of the supply. Should it not come fast enough, or should the drip be on too fast a scale, the variation of the time-marking will be considerable. In what may be called the better class of instruments, a pearl was "holed" and used for the orifice, as that "jewelling" was supposed to resist the wearing away by the water, and the choking by impurities.

In the Athenian Courts of Justice, there was an officer appointed to take charge of the clepsydras, to see that they were properly in good working order, &c. Such a functionary has his modern representative in the weekly clock-winder. Many were the contrivances in the manufacture of clepsydras to make one better than another; indeed, the work of improvement has a strong ancient family likeness to the invention, labour, and industry of escapements, pendulums, balances, and "springing and timing" of our own day. For instance, one form would have a conical supply pipe (a float to mark the height of the water, and a kind of "cut-off" and waste pipe) leading into the timing cylinder, such cylinder being fed by drops of the water only. The side of it had a scale the entire length, which scale was marked with the hours of the day in two divisions of twelve hours each. The bottom of the scale began with I. of the clock, and so continued until XII., when it began at a second I. and again ended at a second XII., thereby dividing the whole day and night into two portions of twelve hours each. The float, which has already been mentioned, had a long rod rising from its centre, the upper half being toothed like a rack. This toothing "took" into a pinion, set upon an arbor in the centre of a ring-dial; upon the same arbor was fixed a hand, covering two sets of hour figures upon the dial, corresponding in numbers with those upon the scale. From these particulars it will be readily understood—that the arrangements of the cone supply would keep the water there at a proper level; that the dripping into the cylinder would raise the float and its staff; that the teeth in the rack would turn the pinion in the centre, and that the hand on the pinion arbor would mark the hours on the ring-dial. When the receiving cylinder was full at the hour of the second XII., the water was suddenly drawn off, and the instrument re-commenced its work. In some clepsydras, the measuring vessel would have a small boat with a projecting oar floating upon the water, and as the water dripped away, the end of the oar would point to each hour as the boat descended. The first of these is an application of what may be termed mechanism, whilst the second is the simple arrangement of a float, falling water, and an index. Who the inventors of either one or the other were has never been ascertained.

With respect to the continuity of the work done by the flowing of the water out of the emptying orifice of the vessel, the following has been laid down as approximately correct.

In all cases the water is assumed to be practically pure, and the drip vent in good, adjusted order.

The care and skill required in the construction of a clepsydra, even without what we understand as mechanism, must have somewhat troubled the "horologists" of those days, as the difficulties were neither so few nor so simple as may at first sight appear. For instance, it was absolutely necessary that in a descending clepsydra, that is, where the index pointer-float sank, equal bulks of water should be discharged in equal times. Now, as the height of the column of fluid and its weight could never possibly be the same from one drop to the end of the next, it had to be in some approximate way provided for. Passing from the descending to the ascending form, entirely different conditions come into operation. The marking vessel containing the measuring float is fed by the drip from a cistern placed a little higher than itself, and the great object in this arrangement is to keep the "feeding" at one uniform level, in order that the pressure upon the outlet shall also be always uniform. Should the level in the cone decrease, it must follow as a certainty that the weight of the "feed" will be less, and the pressure on the drip-vent suffer in the same proportion. In addition to these, there was the "temperature error," both high, low, and middle. Our present "springers and timers" may take consolation in the midst of *their* griefs that such error was not unknown to their brethren even in those distant ages.

As the temperature of the air rose, the water in the feeding-cone rose with it, and with the rise in bulk came the decrease in weight; for if the cone held a gallon of water at the temperature of, say, 60 degrees, when that standard rose to 70 degrees the cone would not hold a gallon, and as such a gallon would weigh about 10 lbs., it followed that a lesser quantity of fluid would have a lesser weight, and the pressure on the drip-vent would be lighter in proportion. Therefore, the falling of the drops would have longer intervals between them—which intervals would make the seconds, minutes, and hours longer than they ought to be. On the other hand, a lowering of the temperature would be a condensation in bulk with its concomitant increase in weight. We do not read of horological patents in those days; or if there were such, the specifications have not come down to us; but without them we have no guessing in arriving at a "pretty safe" conclusion, that the pipe and drip-vent makers—*i.e.*, the "springers and timers"—of the period had their own special troubles; the troubles of isochronising their water-fillings and their water-droppings. How many "beats," or rather drops, went to the hour has not reached the nineteenth century; but one thing is quite clear, and that is, that the colder and denser the water became, the greater would be the number of the said "beats," and the "watch" would go too fast; whilst the warmer the water the fewer the beats, and the "dripper" would drip too slow. From what has been now said, the great anxiety of the "horos." then was to get isochronism; isochronism in water drops, 'tis true, but isochronism at any cost.

The names of all the "inventors" of water-clocks would be legion—if we knew their names; but what is the good of going learnedly into the matter, speaking of Sextus Empiricus, Scipio Nasica, and many others, who all have something to say about the work, but do not tell who did it.

The clepsydras went out of sight until the middle of the sixteenth century, when they were revived in a modern form. Dom Charles Vailly, a Benedictine monk, became the "father" and restorer in 1690. He was known to be a finished mathematician of a practical kind. He laboured hard with experiments, combinations, &c., to render the instrument a reliable modern timekeeper, and was said to have been very successful. He ought to have lived in the early days of India, when he might have changed the current of the following highly romantic story.

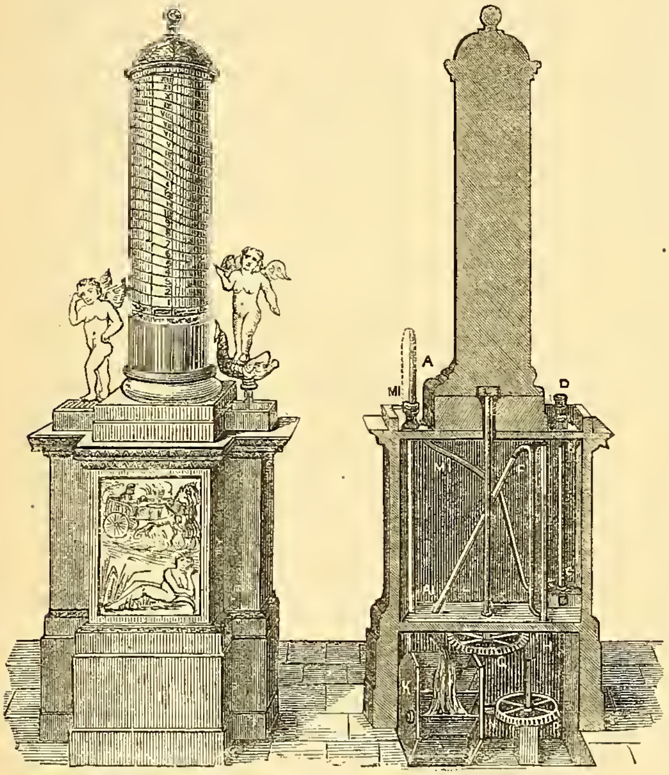
The foundation upon which the knowledge of the use of the clepsydra in India rests, is to be found in the arithmetical treatise of Bhascara, written in the twelfth century. Bhascara, mixing up astrology with numbers, evolved a prediction at the birth of his daughter Liliwati, that she would die unmarried. The child grew up to Indian womanhood, and the father then determined to do battle against the prophecy. Accordingly, he procured a bridegroom, and by astrological computation fixed upon a "lucky hour." He placed his daughter in her bridal dress and ornaments in waiting by the clepsydra. There she sat watching for the hour that was to enable her and her father to set Fate at defiance. At length, the day gave signs of waning, and a ghastly tremor seized upon Bhascara; an examination disclosed the fatal truth that the hour had passed unnoticed. The clepsydra was appealed to, when it was ascertained that a pearl had fallen into it from the lady's dress, and so closed up the vent through which the dropping water should have gone. According to her father, Fate could not—dared not be invoked again, and, turning in depair to his heart-broken daughter, he exclaimed: "I will write a book of your name which shall remain to latest times." Nearly seven hundred years have rolled themselves into the ocean of the past, and the Liliwati remains!

But of all the contrivances for time-keeping since the days begun, none has ever surpassed in originality and beauty the one I am now about to describe, and that is the Clepsydra of Ctesibius. This celebrated inventor was a mathematician, of Alexandria, who flourished about a hundred years before the Christian Era. His Clepsydra was, of itself, the mechanical wonder of the ancient world; and to him and his memory, beyond all question, belongs the glory and the imperishable fame of being the first Worthy of Horology who placed before civilisation the application of wheelwork to the continuous measurement of the hours. The two illustrations given in this paper represent the instrument in complete working order, and in section to show the mechanical arrangement. Let me first explain the external aspect.

The reader will notice a column standing on a pedestal, with a child on each side. The one on the left-hand is shedding tears, as can be seen, drop by drop. These tears come from a cistern in the interior of the pedastal, which cistern has a constant level of water, which will be explained presently. The child on the right-hand is standing on the back of a dolphin, which is fixed to an upright round rod, the child having an arrow in its right hand, pointing to the figure 6 on the column. The action is as follows: As the tears fall from the child on the left-hand, they pass through the surface at its feet out of sight into the pedestal. In their course they set in motion some mechanism that causes the recording child to rise. The column turns on its axis, and it will be observed that there are two circles at its base. The lower one contains the signs of the Zodiac, and that above it the names of the months of the year. On the column is a spiral ribbon, upon which, facing the observer, are two sets of figures in number each from 1 to 12, and from I. to XII. These indicate the twelve hours of the day, and the twelve hours of the night.

We will now turn to the illustration in section on the right-hand, and see how the children and the pillar mystify us; in fact, look upon the earliest form of what may be termed clock wheelwork known to history, and very ingenious it all is.

On the left-hand side of the drawing in section, by the base of the pillar, is the letter A, beside the tube that goes up the interior of the statuette of the weeping child. This tube is connected with the reservoir below. Upon examining the hollow portion of the pedestal, we see a second tube M¹, its upper end fitting into a small hole near where the tears spring from. Through this hole the tears fall after passing out of the eyes of the child, and are carried off by the vent tube M¹ across the pedestal base into an upright narrow channel B C, on the right. There we find a square cork float that fits the channel easily, into which float is fixed the round wooden rod that has been previously mentioned. On the top of this rod, it will be noticed, there is a socket upon which the dolphin rests, on whose back the recording child stands. As the channel in which the float is becomes filled, the recording statuette will rise in proportion. A little to the left at A¹ is a syphon leading diagonally to the right-hand upper corner F, coming straight down and bending into the narrow channel B C, under the float D.



When the water has filled this channel at the end of twenty-four hours, it will, as a hydrostatic necessity, reach the upper end of the syphon, which article will then be put into action as a matter of course, in accordance with part of the law of fluids. The water that filled the channel will flow entirely out of it through the syphon, leaving the channel empty. Upon passing through the syphon, the water will be seen falling into the bucket of a small water-wheel K, in the lower left-hand corner of the pedestal. This wheel has been made to turn once round in six days, by the water filling its six buckets successively. On the axis of the water-wheel will be seen a pinion N, turning a crown-wheel P.

(I will pause here to dwell upon the fact that this crown-wheel of two thousand years ago is identical in principle and construction with the crown-wheel of the well-known English verge watch. So there is another contrivance that is not new under the sun.)

From the crown-wheel P, and the pinion on the water-wheel arbor, the mechanism of clockwork may be really said to begin. At the end of the crown-wheel arbor is another pinion H, engaging in a wheel G, which turns the arbor L, and with it the whole column, as the latter is fastened upon it. As the water-wheel revolves once in six days, its pinion turns the wheel P, which has ten to one in teeth against the leaves of the pinion.

Consequently, the crown wheel will go ten times slower than the water-wheel pinion; it has also a pinion of its own, and this pinion makes only one revolution in sixty days, taking into the wheel G, the latter revolving in 360 days. The column being attached to the arbour of tho wheel G at L also revolves in 360 days. From these 360 days, at that period, the year was computed. Although the column turned completely round once in the year, it had other devices upon it for its several purposes, days of the month, &c. But, it may be asked, if that was the fact about the annual revolution of the column, how could the recording child tell the hours every day? That was managed by the action of the water under the cork float. When the twenty-four hours had expired, the water that had raised the recording child had reached the point that set the power of the syphon in motion, and in a few seconds the float was again at the bottom of the narrow, upright channel B C, with its burthen of the recording child on its dolphin at the base of the column, again at its duty of numbering the hours of the newly-born day. And such, good reader, such was the renowned Clepsydera of that most ancient worthy of Horology—Ctesibius.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

*(Continued from page 161.)**

Table of Proportions of Fine Silver and Copper to compose Standard:—

To 1 ounce Fine Silver	.. add	·084 ounce Copper.
·95 ,, ,,	..	·077 ,, ,,
·925 ,, ,,	Standard	·075 ,, ,,
·9 ,, ,,	..	·073 ,, ,,
·85 ,, ,,	..	·069 ,, ,,
·8 ,, ,,	..	·066 ,, ,,
·75 ,, ,,	..	·062 ,, ,,
·7 ,, ,,	..	·059 ,, ,,
·65 ,, ,,	..	·054 ,, ,,
·6 ,, ,,	..	·050 ,, ,,
·55 ,, ,,	..	·046 ,, ,,
·5 ,, ,,	..	·042 ,, ,,
·45 ,, ,,	..	·038 ,, ,,
·4 ,, ,,	..	·034 ,, ,,
·35 ,, ,,	..	·029 ,, ,,
·3 ,, ,,	..	·025 ,, ,,
·25 ,, ,,	..	·021 ,, ,,
·2 ,, ,,	..	·017 ,, ,,
·15 ,, ,,	..	·013 ,, ,,
·1 ,, ,,	..	·009 ,, ,,
·05 ,, ,,	..	·004 ,, ,,
·025 ,, ,,	..	·002 ,, ,,
·012 ,, ,,	..	·001 ,, ,,

Of the various methods of calculating the value of Bullion, the most practical are by ascertaining the quantity of Standard contained in the gross weight as in example in No. 83, page 149, and finding the whole value per ounce and parts thereof in tables to be published for the purpose in course of progress of this Guide, or by finding the value of an ounce and parts thereof by the value of the Assay-report, in order to obtain the value of the gross weight as in examples in No. 84, on pages 148 and 149.

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* Errata.—On page 161 in our last number, in "Decimal Weight and Millieme Report," for $\frac{50}{100}$ read $\frac{50}{1000}$.

All other methods are more or less complicated, and of no advantage for making calculations in practice.

The following examples exhibit rules and calculations to ascertain the quantity of Standard Gold in a given quantity of Bullion.

EXAMPLE 1.

In 154 ozs. of Gold reported 2 car. *Worse*, what quantity of Standard?

```
Report.        Gross Weight.          Standard.
2 multiplied  by  154 ozs.  divided  by  22
                    2
                 ───
                22)308(14
```

From the gross weight of 154 ozs. take the result of 14, leaves 140 ozs. Standard Gold.

EXAMPLE 2.

What quantity of Standard Gold is contained in 530 ozs. 8 dwts. in Gold reported 2 car. 3 grs. *Worse*?

Convert the report as well as the standard to grains by multiplying the carats by 4, and bring the gross weight to dwts. by multiplying by 20. Muliply the obtained report by the obtained gross weight and divide by the obtained standard. Re-convert the result to ozs. and dwts., and deduct from the gross weight; the difference is the quantity of Standard Gold sought for.

```
Report.          Standard.          Gross Weight.
car. grs.          carat              ozs. dwts.
 2   3              22                530   8
   4                 4                    20
───────            ────              ───────
11 grs,            88 grs.            10608 dwts.
                                         11
                                     ───────
                                  88)116688(1326
        20)1326 dwts.(66 ozs. 6 dwts.
                                  ozs. dwts.
        From the Gross Weight ..  530   8
        Deduct the Result     ..   66   6
                                 ────────
          Leaves Standard Gold    464   2
```

Answer—464 ozs. 2 dwts. Standard Gold.

EXAMPLE 3.

In 176 ozs. 16 dwts. reported 1 car. 1½ gr. *Worse*, what quantity of Standard?

Convert the report and standard into quarter grains, by multiplying the carats by 16 and the grains by 4; deduct the obtained report from the standard, convert the gross weight into dwts., multiply by the difference from deducting the report from standard, and divide by the Standard; the result is the quantity of Standard Gold contained in the gross weight.

```
22 multiplied by 16   =   352     Gross Weight 176 ozs. 16 dwts.
1 car. 1½ grs. to ¼-gr. =  22     Into dwts.   ..   20
                          ───                      ────
           Difference     330                      3562
                    Multiply by Difference          330
                                                 ───────
                Divided by Standard 352)1166880(3315 dwts.
```

Answer—3315 dwts. = 165 ozs. 15 dwts. Standard Gold.

EXAMPLE 4.

In 353 ozs. 12 dwts. reported 2¾ grs. *Better*, what quantity of Standard Gold?

To quarter-grain standard add quarter-grain report, multiply the obtained sum by the gross weight converted into dwts., and divide by the quarter-grain standard; the result is the quantity of Standard Gold contained in the gross weight.

```
                                    ozs. dwts.
    ¼ gr. Standard 352   Gross Weight 353  12
add   ,,  Report    11   Into dwts.   ..   20
                   ───                   ────
               Sum 363                   7072
                        Multiply by ¼-gr. 363
                                       ──────
Divided by ¼-gr. Standard 352)2567136(7293 dwts. Stand. Gold.
```

Answer—7293 dwts. = 364 ozs. 13 dwts. Standard Gold.

It frequently happens that the quantity of Standard contained in several quantities of Bullion, of various weights and qualities, is collectively required, for which purpose the following rule is given, whereby great part of the trouble of calculating each quantity separately is saved.

"Each quantity is multiplied by its respective fine contents, the products added together, and their amount divided by the Standard gives the quantity of Standard contained in the collective quantities of Bullion."

When one or more of the collective reports of Silver Bullion partake of dwts. and half-dwts., every report and fine contents, as well as the Standard, has to be converted into half-dwts; and when one or more of the collective reports of Gold Bullion are expressed in carats and grains, every report and fine contents, as well as the Standard, has to be converted into grains by being multiplied by 4, and when one or more of the reports are expressed in fractions of grains, every report and fine contents, as well as the Standard, has to be converted into quarter-grains, which denote the 16th part of a Carat, and the final division be effected by the respective carat, grain, or quarter-grain standard.

When one or more of the quantities of either Gold or Silver Bullion have dwts. above full ounces, every quantity has to be converted to the denomination of dwts.

This rule is not only calculated for the English Standards, but is equally applicable to any other quality; for if the quantities multiplied by their respective fine contents are divided by any given quality, the result will be the quantity sought for of the quality given.

EXAMPLE FOR SILVER BULLION.

What quantity of *Standard Silver* do the following quantities of Bullion contain:—

```
ozs. dwts.                                   ½-dwts. Fine Contents.
176   16  reported  8½ dwts. Worse contain  ..   427
530    8     ,,     14   ,,  Worse     ,,   ..   416
353   12     ,,      6½  ,,  Better    ,,   ..   431
─────────
1060  16  collective gross weight.

ozs.  dwts.            ozs. dwts.            ozs.  dwts
176    16              530    8              353    12
   20                     20                     20
  ────                  ─────                  ────
  3536                  10608                  7072
   427                    416                   431
───────               ────────              ───────
1509872            to  4412928              3048032
                   add 1509872
                   add 3048032
                      ────────
                 444)8970823(20204½ dwts.
```

Answer—20204½ dwts. = 1010 ozs. 4½ dwts. Standard Silver.

1010 ozs. 4½ dwts. Standard Silver in collective quantities of Bullion of the gross weight of 1060 ozs. 16 dwts., leaves 50 ozs. 11½ dwts. *Alloy in excess*, which would have to be neutralised by addition of *Fine Silver*, according to tables on page 160 of last month's issue of this journal, in order to make the mass into Standard Silver.

Example for Gold Bullion.

What quantity of Standard Gold does the following quantities of Bullion contain?

ozs.	dwts.						$\frac{1}{4}$-gr. Fine Contents.
154	0	reported	2 car.		Worse	contain ..	320
176	16	,,	1 ,,	$1\frac{1}{2}$ gr.	Worse	,, ..	330
530	8	,,	2 ,,	3 ,,	Worse	,, ..	308
353	12	,,	0 ,,	$2\frac{3}{4}$,,	Better	,, .	363
1214	16	collective gross weight.					

ozs. dwts.	ozs. dwts.	ozs. dwts.	ozs. dwts.
154 0	176 16	530 8	353 12
20	20	20	20
3080	3536	10608	7072
320	330	308	363
985600	1166880	3267264	2567136

To 985600
add 1166880
add 3267264
add 2567136

352)7986880(22690 dwts.

Answer—22690 dwts. = 1134 ozs. 10 dwts. Standard Gold.

The above answer will agree with the collective answers of examples 1, 2, 3, and 4, as above, separately calculated.

The Standarding of Gold Bullion reported *Worse* is not resorted to for Coinage, on account of the *uncertain* metals of alloy contained therein, which would materially alter the required colour of the Metal, and such Bullion has therefore to be *refined*, but Gold Bullion reported *Better*, is generally Standarded at the Royal Mint by adding the required quantity of Copper *only*, without ascertaining the nature of the alloy already contained therein, provided the alloy does not interfere with the malleability of the metal; hence we occasionally find Sovereigns of a slight variation in colour.

The Standard and Fine contents of Gold Bullion expressed in Carats and Grains may be converted to Decimals by the aid of table on page 148.

For the conversion of Standard and Fine Contents of Silver Bullion expressed in ozs., dwts., and half-dwts., and for the conversion of the old Troy weight to Decimals, tables are in preparation and will appear in course of continuation.

Gold Bullion, in quantities of not less than 100 ounces, and refined to at least Standard, may be offered for sale to, and is readily bought by, the Bank of England on the report of the appointed Assayer to the Bank, at the rate of Bank value of £3 17s. 9d. per ounce of Standard contained in the Bullion, and paid for in sovereigns at the rate of Mint value of £3 17s. 10½d. per ounce weight.

(*To be continued.*)

◆

Our National Watch Factory—*By a Horological Zadkiel.*—The first of a series of Articles under the above heading will appear in our next issue, and we can promise our readers that their contents will be of unusual interest. During the seven years that this journal has been established, it has invariably advocated progress in the various branches of industry which it represents; and in the present critical condition of the watch trade, we feel that any contemplated scheme of reform in the system of manufacture cannot be too fully ventilated The writer of the Articles in question prefers to withhold his name for the present, but the opinions set forth will command respect on their merits, and we anticipate an interesting discussion will arise in consequence of their publication.

The Society of Arts Patent Bill.

The Bill for the Amendment of the Patent Law, prepared by the Council of the Society of Arts, has been brought in by Sir John Lubbock, Mr. W. H. Smith, and Mr. J. C. Lawrance, Q.C. The following are some of the principal alterations which would be effected by this Bill;—

Novelty.—By one of the interpretation clauses it is provided that an invention is to be deemed new unless it has been published, or publicly used, within a period of thirty years preceding the date of the application for a patent for it. The object of this is to prevent the invalidation of a possibly useful invention by an old, and it may be incomplete, description of something like it. At present, an otherwise good patent might be overthrown on the ground that the invention had been anticipated by a description in an obsolete and unknown book, of which a single copy existed in the British Museum.

Subject-matter of Patents.—For the first time in any Act or Bill dealing with patents, an attempt is made to define what is subject-matter for a patent. Under the present Act, the only definition is that contained in the Statute of James I., known as the Statute of Monopolies, namely, "any manner of new manufacture within this realm."

Commissioners of Patents.—The Bill provides for the appointment of a Board of Commissioners of Patents, to consist of an engineer, a chemist, and a lawyer. These Commissioners are to carry on the duties of the existing Commissioners, and certain other functions specially provided by the Bill.

Application for and Grant of a Patent.—An applicant for a patent would be required to lodge his application, as under the present law, accompanied by a provisional specification, and would receive provisional protection for his invention on such application. The provisional specification would then be referred by the Commissioners to an Examiner, who would report whether the invention was subject-matter for a patent, whether the title was sufficient, and whether the provisional specification was in accordance with the title. If the Examiner reported adversely, the application might be proceeded with, but in that case every copy of the patent would be endorsed with a statement of the Examiner's report. The next step on the part of the applicant would be the lodging of a complete or final specification, together with a written request for the sealing of the patent. This final specification would be examined in the same way as the provisional, to see if it agreed therewith, and also whether the nature and object of the invention were stated with sufficient clearness. No examination whatever as to the utility or novelty of the invention is contemplated. Provision is also made for cases in which the applicant prefers to file a complete specification in the first instance, without the preliminary step of filing a provisional. On the grant of the patent, the complete specification is to be published. If the application be not proceeded with, the provisional specification would be destroyed. The object of this is to prevent the incomplete description given in an abandoned provisional specification from interfering with any future application for a patent for a similar invention.

Duration of a Patent.—Fees.—The term of the patent is to be seventeen years, subject to the payment of duties of £5 on the grant, £20 at the fourth year, £50 at the eighth year. The fee on application is set down at £2 10s. The total cost of a patent, in the first instance, would thus be £7 10s.; and the fees for the full term would amount to £77 10s.

Amendment.—Large powers of amendment are given under the Bill.

Prolongation.—Applications for prolongation would be made to the Board of Commissioners, not, as now, to the Privy Council. Prolongation could be granted for any period not exceeding eleven years. No conditions could be made in respect of an order for prolongation, and special instructions are given to the Commissioners as to the points which they would have to consider in granting or refusing it.

Patent to Bind Crown.—As in some previous Bills, but not under the existing law, the patent is to have the same effect against the Queen as against a subject. Certain limitations with reference to naval and military service are provided.

Compulsory Licence.—In certain very special cases the Commissioners are permitted by the Bill to order a patentee to grant licences.

Duties of Commissioners.—The duties of Commissioners are stated at greater length than in the Act of 1852, or than in any previous Bills. It is specially laid down that they are to prepare indexes, abridgements, and such other works as they think proper; to keep open a museum and library free of charge; and to print and keep on sale copies of all specifications, &c.

Patent Actions.—By a provision under this head, a defendant in a patent action is not allowed to set up as a defence that a part of the patent other than that stated to be infringed is invalid, and thereby the whole of the patent vitiated. The Commissioners are to act as assessors in patent actions when required by the Court, or patent actions may be referred by order of the Court to the Commissioners instead of to an official referee; and further, it is to be the duty of the Commissioners to act as arbitrators whenever the parties to the action agree.

There are many other points of importance in the Bill, but the above comprise those which would effect the greatest changes in the present practice.

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Waltham Watches.

By Hy. Ganney.

Having been asked by Mr. Bedford, the London representative of the Waltham Watch Co., to reconsider the statement made in my last communication as regards England supplying American watches with their best material, I have no hesitation in bearing testimony to the fact that the Waltham Co. can, and do, make all parts of their watches under their own roof, and are in no sense dependent upon outside assistance, except, perhaps, in the matter of main springs; at the same time, the statement made is quite correct, as the agent of the Waltham Co., Mr. Stratton, the inventor of the most original idea I have seen in connection with American watches, viz., a barrel that formed its own ratchet with teeth on its sides, and was wound instead of the arbor. Mr. Stratton was about twenty years agent for the Waltham Co. in England, and his duties began and ended with sending men and material from here there, before the opening of the wholesale depôt in London. Many of those who worked on American orders have become quite *au fait* at their methods, and would like, as the American trade grows in this country, to share their prosperity; and only complain, that as American watches grow in character and quality, they are not allowed to send anything like the same proportion of work and material, the Waltham Company aiming at independence.

I do not see any necessity for asserting too strongly Horological independence by any one country; we all beg, borrow, or steal whatever ideas come handiest; pride, not honesty, prevents us in England adopting much that we could adopt with advantage from both America and the Swiss. Diogenes, in search of an honest man, did not, I suppose, look amongst watchmakers. We have got so used to taking the credit of other's talent and work, that we are indignant if the honours of production do not follow upon purchase. A watch of our own make, simply means a watch bought of a compiler who bought the various parts from the makers. The strength and weakness of the American watch lies in the fact, that they guarantee and make the article they supply the public through their agents, the retailers.

The American trade in England could be doubled tomorrow, could they supply a watch, the nationality of which could not be proved readily, so that retailers could sell it as our own make—and here lies a chance for machine watchmaking in England. There is quite a fortune to be made in filling the orders the American Waltham Company now find it impossible to execute, though turning out nearly 1,500 daily.

Coventry could do some good for itself, could it guarantee the character and uniformity of its low-class work; and at present, I doubt not, could supply, when trade is slack, work as good and cheap as Waltham. But intelligent men will not trade with them, or build up a trade for them, when they are slack; because they cannot trust them. As soon as they are busy, the raising of prices does not matter much, but the utter destruction of all chance of useful performance invariably follows. The Waltham Company was really formed by American Coventry Watch Importers, who wanted to supply Coventry watches in large quantities, and could not; as when trade was brisk all profits vanished in getting a performance out of them. Selling a watch in America is not like selling a watch in London. A man there, who buys a watch, does not if it goes badly, bring it back with another pound or two and try a better one; he comes back with a revolver, generally in his coat pocket, and wants his money, and gets it too. The rule of the English retail trade—no money returned—will not do there, it is perfect satisfaction, or money refunded. I have seen watches returned after twelve months wear and full amount paid, returned; not to be willing to refund money paid is considered proof of dishonesty there. The thing is to get a sale, and there can be no doubt that the importance of selling has quite discredited making. "Fools make watches, clever men sell them," said a leading London dealer to me when I refused to associate more importance with selling than making. That was twenty-five years ago. We differed and parted, I to work out my own idea that the maker should be the most important interest, and have lived to see and helped to make the fact, that the Waltham watchmakers are more important factors, in London Horological life, than any mere dealers in other people's productions. I always had an idea when the Waltham business in England was large enough, that the Waltham Company would found a branch factory here, but they have declined to do so, so must meet rivals. They reckon the superior intelligence and sobriety of Americans, will always enable them to compete with our cheap labour, which, perhaps, is England's curse. Cheap labour fosters pride of uselessness, and insolent caste of idleness; but we are getting a more sober people, and have a better climate for work—more necessity for it than America, their sun and soil will keep them in comfort; but we, in the future as in the past, must live by work. Handling other nations productions may make riches quickly for the few, but the nation must depend on its productive powers for its resources.

[Nobody acquainted with Mr. Ganney would, for a single moment, consider him capable of willingly misrepresenting friend or foe; but with all his experience and power of observation, he is as liable to mistakes as any other mortal. The fact is, that Mr. Gauncy's article in last month's journal, as far as American watchmaking is concerned, is mainly based on experience gained in the United States, 12 or 15 years ago, which, in a country moving with such rapidity in manufacturing enterprise, means a generation. What the Waltham Company and Mr. Stratton did at that period, is of the past, and in nowise represents American watch manufacturing as carried on to-day.—Ed.]

The Triplex Escapement.*

From the "Allgem. Journal der Uhrmacher Kunst."

THE Triplex Escapement may be classified with "detached Escapements," that is, with such, where the Balance after impulse performs its vibration free of the action of the Escapement, as in the Lever Escapement, &c. It is a Chronometer Escapement with an impulse at each vibration, the ordinary Chronometer Escapement only giving impulse every second vibration, the Escape-wheel reposing during the intermediate one.

To solve this interesting problem, viz., the construction of a Chronometer with double impulse, it is necessary to have three concentric wheels on the axis of the Escape pinion.

Two of these are the impulse wheels with ten, twelve, or fifteen teeth, as the case may be, and the detaining wheel, with a number of teeth equal to twice that of either impulse wheels, or equal to their sum. There is also a Detent necessary, which is represented by d in the diagram.

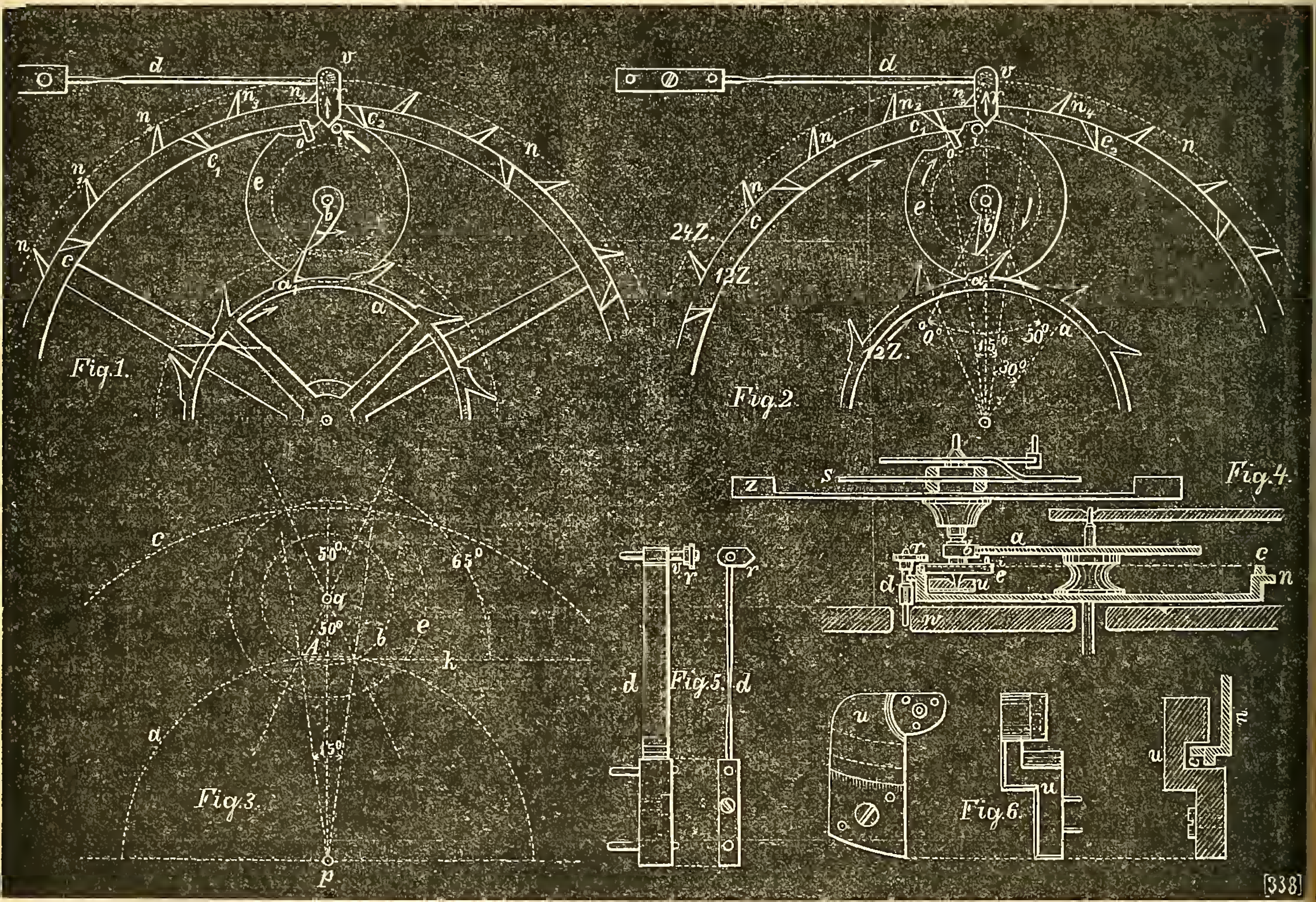


Fig. 1 and 2 show the action of the Escapement in two consecutive vibrations. Fig. 3 shows the method of designing the plane of the Escapement, with a given radius of the minor wheel. Fig. 4 shows the elevation and sectional proportions. Fig. 5 the Detent, and Fig. 6 the several views of the pottance.

The outer or major impulse wheel has here 12 vertical teeth, c_1, c_2, &c.; it has a deep groove, so as to clear the pottance u.

On the circumference of the larger impulse wheel, and level with the Plane of the wheel, are the detaining teeth n, n_1, n_2, n_3 of the detaining wheel with 24 teeth.

Above the plane of the double wheel $c\,n$, is the minor or inside impulse wheel a, with twelve teeth; these act on the impulse pallet b, whereas the major wheel acts on the impulse pallet o, inserted into the impulse Roller e. From the impulse Roller e projects the unlocking pin i vertically, which makes alternative contact with the inclined planes of tooth r of the Detent; below the tooth r is the detaining pallet v, which acts into the teeth of the detaining wheel n. The Detent d returns to its former position after each unlocking. The angular motion of d, in the direction of the wheel, is limited by the Plate n, as shown in Fig. 4; z represents the Balance and s the Balance spring. The pottance u must be so formed, that the lower pivot of the Balance has a firm position between the two impulse wheels.

The action of the Escapement is easily seen on an inspection of Figs. 1 and 2. In Fig. 1 the Balance moves from left to right, the unlocking pin i is just in the act of relieving the detaining tooth n_4, after which tooth a_1, of the minor impulse-wheel, with 5° of drop, makes contact with the impulse pallet *b*. When the impulse is completed, the detaining tooth n_3 reposes on the detaining pallet *v* of the detent *d*, and the Balance continues its vibration, until the tension of the Balance spring causes the return motion. In Fig. 2 the movement of the Balance from right to left is shown at the instant, when the unlocking pin *i* relieves again the detaining tooth n_3, when, after an angle of drop of 5°, the tooth c_1, makes impulse contact with impulse pallet *e*. After completion of impulse the Balance performs the free vibration, at the end of which the action shown in Fig. 1 is again repeated.

---

* This Escapement was first brought to London by an American gentleman, and patented here and in America. It was executed in watch form by Messrs. Thompson and Vine, then of Percival Street, Clerkenwell, in the year 1858. Reference is made to it in the section of "Horology," by I Herrmann, *Cassell's Technical Educator*, page 371.

The Escapement may be constructed on various given conditions; the line of centres *p q* (Fig. 3), the Diameter of the major wheel *c*, or of the minor wheel *a*, may be taken as a unit or basis. If the line of centres *p q* is given, the problem is the simplest to solve, because after the impulse angles (here 50° and 15°) are set out, the radii of the points of intersections, determine the radii of circles *a* and *b*.

If we assume the diameter of the minor wheel *a*, with twelve teeth, as the known quantity, and the angle of impulse at 50°, then we have to determine the distance between the points of two teeth, because the angular motion of the wheel during impulse is equal to half this measure, and a line drawn to the tooth of the major wheel bisects the angle contained by any two points of the minor wheel. With a wheel of twelve teeth, this angle $= \frac{360}{12} = 30^\circ$. The half of this angle = 15° is marked off on each side of the line of centres = 7° 30′ on each side; the radius of the smaller wheel (30 m.m in Fig. 3) is known.

The points of intersection of the two radii, enclosing an angle of 15°, are joined by the produced line K. To obtain an impulse angle of 50°, we have to mark off from A an angle of 65° with A K, the point *q*, where this line cuts the line of centres, being the centre of the Balance.

If we wish to obtain an angle of impulse of 50° from the major wheel, then the radii of the angle of 50° are produced on the opposite side, and the magnitude of the roller *e* or wheel *c* can be assumed; either one forming the unit of the other.

In Figs. 1 and 2 the impulse of the roller somewhat exceeds 50°.

We have to thank Mr. M. Grossmann for the publication of the Triplex Escapement, whose models of this Escapement have been at the service of watchmakers for study and inspection. The execution of such an Escapement forms an interesting study for apprentices, the rough parts being furnished by Mr. M. Grossmann.

This Escapement is probably of American origin, as the first specimen was transmitted to Mr. M. Grossmann, in the form of a watch, from San Francisco, by Mr. W. H. Lamb. The Escapement vibrates well, and cannot easily be set, which is not the case with the ordinary Chronometer.

Queries and Replies.

S.S.—Dr. B. Kaylor's Lacquer Recipe.—How is the shellac solution produced? and is "Picric" Acid the generally understood name for that acid, or has it some more familiar name?

Reader.—Instead of ½ decilter read ½ deciliter (French measure). Your chemist is not very sharp, otherwise he would have discovered that it was simply a misprint.

Trade Notes.

Our American exchanges report a lull in the jewellery trade, but it is regarded as temporary only.

Alfred Tilley, seventeen, was found guilty of stealing a diamond brooch, valued at £150, and a second brooch, worth £13, the property of a jewellers' firm in St. James's Street. Mr. Willis prosecuted; and Mr. Keith Frith defended. There was a second charge of stealing jewellery worth £50 from a jeweller's in Fenchurch Street. In each case the prisoner entered the shop early in the morning, when the jewellery had been taken from the window and was on the counter, and having asked for a watch key he effected the robbery.—Sentenced to eighteen months' hard labour.

The Sheffield Plate Manufacturing Company has been formed to purchase the Gatefield Works, Sheffield, and to carry on the business of electro-plate and Britannia metal manufacturers thereat. Capital: £10,000, in £10 shares. Signatories (with one share each, and all of Sheffield): W. Ryland, A. Burniston, H. Howe, W. Horrell, S. Smith, E. Cadman, C. A. Combe. Directing qualification: The holding of ten shares. Remuneration to be hereafter fixed. Registered May 15th, 1882, by C. W. Taylor, 31, Crutched-friars.

A droll story is told of Sir John Bennett's adventures at Epsom. Sir John was shewing his horsemanship with his usual unassuming grace, when he was stopped by a policeman. "Don't you know who I am?" said the Knight loftily. "I'm Sir John Bennett." The officer, who was gazing intently at an elaborate timepiece, remarked brusquely, "Oh, I dare say; we have had two or three Sir John Bennett's to-day. I am too busy just now watching *Benson's* chronograph."

Messrs. Robinson & Co., Diamond Merchants and Dealers in Precious Stones, brought an action against Messrs. Dumas and another, Insurance Brokers, to recover £800, the value of the insurance of two parcels of sapphires, which were stolen in the recent Hatton Garden Post-office robbery. The defendants pleaded that the loss occurred before the insurance could be effected, and denied their liability. It transpired that it was the practice of the trade to send the jewels to the post, addressed to their clients in registered letters and then to insure them. Plaintiff always sent the instructions for insurance, and posted them at the same time they posted the letters, with the jewels in registered letters. In this way, on the 16th of November last, the plaintiff despatched two registered letters addressed to different parties in France containing the sapphires, but the orders to the defendants for the insurance were not delivered until the following morning, when the plaintiff heard of the rumour of the robbery, which was afterwards confirmed. An insurance was effected, but on the terms, "free from robbery already reported." The defendants, however, resisted payment of the insurance on the ground that the jewels were not actually insured, and on the other hand, the plaintiff contended that as he followed the usual practice of posting the instructions to insure at the time he posted the jewels, he was entitled to the insurance. It was urged by Mr. C. Russell on behalf of the defendants, that the posting of the insurance orders to the defendants did not render them liable for the insurance. After some lengthy argument on both sides, the jury returned a verdict for defendants, for whom his lordship gave judgment.

Mr. H. A. Coombs, of 16, Fenchurch Street, London, E.C., has introduced a novel method of advertising, which will certainly commend itself to shopkeepers desirous of keeping their names before the public. One of these advertisements takes the shape of a pencil, protector, with pen and rubber eraser, stamped with advertiser's name in prominent gold letters; another one consists of a calendar pencil; and a third of a parchment slate note-book. The prices of these goods are so low that they hardly exceed the cost of a good card, and they certainly form a more acceptable and more permanent advertisement.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

XXXVI.

Nielled Silver.—This is a kind of inlaid enamel work, and is obtained by the sulphuration of certain parts of a silver object. But instead of being direct, this is produced by inlaying the silver surface with a sulphide of the same metal prepared beforehand. For preparing the niel, heat a certain proportion of sulphur in a deep crucible; heat a certain quantity of silver, copper, and lead in another crucible, and when melted pour into the fused sulphur, which transforms these metals into sulphides: then add a little sal ammoniac, remove from the crucible, pulverize for use. First crucible:—

Flowers of Sulphur	27 oz.
Sal Ammoniac	$2\frac{3}{4}$ oz.

Second crucible, which, after fusion, is poured into the first:

Silver	$\frac{1}{2}$ oz.
Copper	$1\frac{1}{2}$ oz.
Lead	$2\frac{3}{4}$ oz.

1. After having reduced the niel to a fine powder, mix with a small proportion of a solution of sal ammoniac, hollow out the engraving upon a silver surface, and cover the whole, hollows and reliefs, with the composition. The article is then to be heated in a muffle, until the composition solders to the metal. Uncover the pattern by a level polish, when the silver will appear as over a black ground. This method is costly, as each article must be engraved.

2. Engrave, in relief, a steel plate, and press it against the silver plate between two hard bodies. The copy is hollow, and ready to receive the niel. A great many copies may be obtained from the same matrix.

Platinum Deposits by Dipping.—Copper and its alloys only will receive a satisfactory platinum deposit; iron, zinc, lead, or tin, coated with this metal, even after a previous coppering, give but defective results. The platinum deposits are obtained by dipping thoroughly cleansed copper articles in the following solution, kept boiling:—

Distilled water, 100 parts by weight.
Caustic soda, 12 parts.
Platinum for neutral chloride.

1. The deposit is bright, durable, and of a dark colour, resembling oxidized silver.

Thin Platinum Electro-Deposits.—The platinum baths for Electro-deposits will succeed when the chloride of platinum is dissolved in a solution of a salt, with alkaline, neutral, or acid reaction, but sulphites and cyanides, even those having soda for base, should be excepted.

Distilled water, 100 parts by weight.
Carbonate of Soda, 40 parts.
Platinum for neutral chloride 1.
Temperature of the baths, from 160° to 180° Fahr.
Distilled water, 100 parts by weight.
Phosphate, or borate, of soda, 60 parts.
Platinum for neutral chloride 1.
Distilled water, 100 parts by weight.
Pyrophosphate of soda, or chloride, or iodide of sodium, 30 parts.
Platinum for dry chloride, 1.

These baths only give exceedingly thin deposits; if the coating were allowed to increase, most of it would be without adherence, and often form scales. The deposit is black, or steel gray.

(To be Continued.)

The English Watch Company (Limited)

Birmingham.

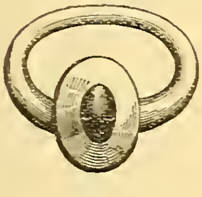
Our readers will be interested in hearing that the English Watch Company, of Birmingham, has recently been formed into a Limited Company. The first statutory meeting was held in Birmingham on the 11th April, when it was explained by the chairman that the business had been bought on very advantageous terms, that there were orders on hand for several months' work, and that the prospects were of a most hopeful character. We have in our columns several times had occasion to refer to the English Watch Company, and to the energy and promptitude shown by the management in adopting new methods of manufacture; and it is satisfactory to find that England means to hold its own in the keen competition that is now going on in the watch trade. We learn that the new Company will have the benefit of having on its Board men of high standing and long experience in the trade. Perhaps no better comment on the interesting letter from Mr. Ganney, which appeared in our last issue, can be made than the statement that a factory like that of the English Watch Company (Limited) is an established fact. Last year we had the pleasure of being the first to notice that this Company had taken the contract for guards' watches for the Indian State Railways, and we have just heard from the Company that they have secured an order for this year's supply. We have had the opportunity of testing one of the watches supplied last year, and can bear testimony to its quality and excellent performance. The watches made by the Company, being produced by machinery, can be got up at prices that are remarkably low, although the workmanship is superior to that of hand-made watches. For instance, the Company can produce a very sound lever at from 45/-, and their makes range from that to chronometers of the highest finish at as many guineas. We understand the Company are about to extend their operations considerably.

Index to Antique Rings and Ornaments.

44—Episcopal Ring in the Sacristy at York Minster; found in the tomb of Archbishop Sewall, who died in 1256.
45—Specimen of the Circular Fibulæ of the Southern Anglo-Saxons, found in Kent.
46—Episcopal Ring in the Sacristy at York Minster; found in the tomb of Archbishop Greenfield, who died in 1315.
47—Ring of Ethelwulf, King of Wessex (the father of Alfred the Great) who reigned A.D. 836—838, and bears the Royal name upon it. It is now in the British Museum.
48—Ring of Ahlston, Bishop of Sherborne A.D. 817—867.
49—Ring of South Saxon workmanship; found in the Thames, at Chelsea, in 1856.
50—Ring worn by the middle class in the time of Alfred. This specimen was part of the treasure discovered in 1840, by workmen employed in digging at Cuerdale, near Preston.
51—Same as 45.
52—Same as 50.

Supplement to the Watchmaker, Jeweller, and Silversmith, June 5, 1882.

ANTIQUE RINGS AND ORNAMENTS.



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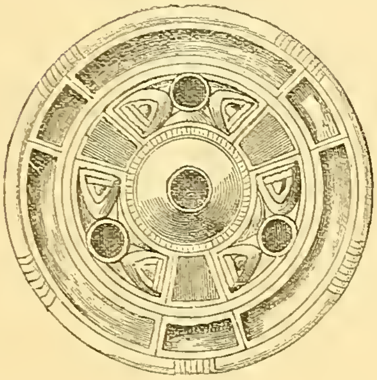

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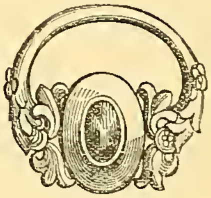

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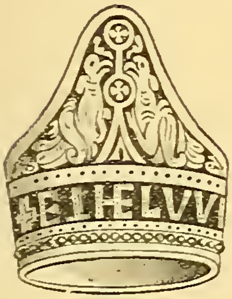

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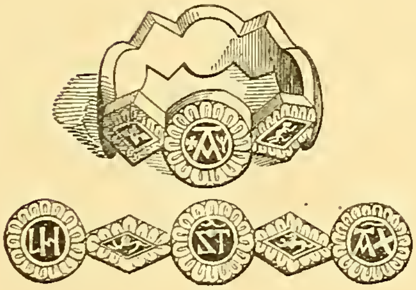

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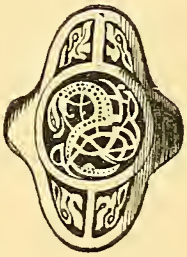

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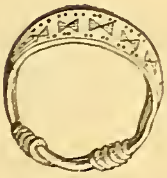

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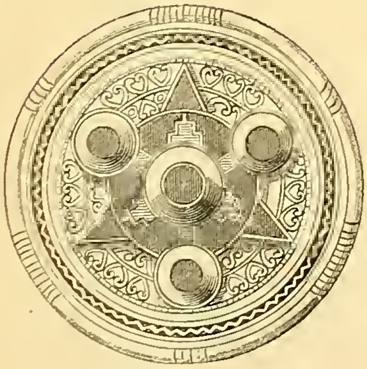

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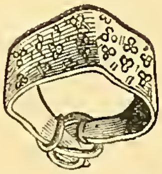

52.

For Description see page 182.

THE

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Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

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ILLUSTRATED SUPPLEMENT:— Prize Design for a Clock.

No. 86.—Vol. VIII.] JULY 5, 1882. [Subscription, 5s. per Annum. Post Free.

Our National Watch Factory.

By a Horological Zadkiel.

Why wear foreign watches when English can be obtained?

The National Watch Manufacturing Company (Limited) are turning out hundreds daily, which are acknowledged to be the best in the world, combining as they do the well-known durability and superior timekeeping qualities of the English, with the hitherto unrivalled elegance of the Swiss.

☞ See the Company's works in full operation at their factory, Clerkenwell Road, London, E.C., where the manufacture is conducted on a scale never before attempted in this country.

Wholesale and Retail agencies established all over the world.

N.B.—Beware of worthless imitations; the unprecedented success of the undertaking having already led to the introduction of inferior goods in certain foreign markets.

This, reader, is the copy of an advertisement which appeared in our leading journals during the autumn of 1886, and is the reason for the publication of the present series of papers, inasmuch as it caught the eye of a citizen of the United States who had just arrived on a visit to this metropolis, after a pleasant and interesting voyage in a five days' ship, and was recruiting his energies by lounging in the luxuriously appointed smoking room of the Fifth Avenue Hotel, Holborn, which palatial edifice had recently been declared open by a member of the Royal Family, who gave it as his opinion that England could only maintain her greatness by keeping ahead of all her competitors, and not by resting upon past achievements. It is unnecessary to give the individuality of the visitor from the "other side;" suffice it to say that he had travelled "some," and was generally believed to be the hero of the anecdote which records that when an American traveller was shown the crater of Vesuvius immediately after a serious eruption, he gazed at it meditatively, and after lighting a fresh cigarette, tranquilly remarked, "I guess we have a tap that would put it out." Therefore, it will be readily understood that his emotions were generally under control, and anything which rivetted his attention might be supposed to be of more than ordinary interest. Singular to say, therefore, he read the foregoing advertisement twice over, and might have been heard to mutter, "Guess I must see this factory; they are either smartening up here pretty considerably, or else some of our own people are at the back of this venture." Taking up a telephonic tube, he requested that a messenger might be despatched for a prospectus; but as one was immediately handed to him, his attention was not long diverted from the matter in hand.

As its contents will prove of equal interest to the readers of this article, as to him, they are hereby reproduced.

THE NATIONAL WATCH MANUFACTURING COMPANY, OF LONDON (LIMITED).

Registered under the Companies Acts 1862 *to* 1880.

Capital £250,000. First issue £150,000 in 30,000 shares of £5 each, of which 15,000 are offered for subscription. Payment, 10/- per share on application, £1 per share on allotment, £1 on 1st September, 1885, and the balance as required, in calls not exceeding £1 per share, subject to thirty days' notice.

DIRECTORS.

John Mainspring, Esq., F.R.S. (Chairman), Cornhill and Kensington.
S. Mandrill, Esq., C.E. (Channel Tunnel Works) Great Victoria Street, Westminster.
J. Turner Pivot, Esq. (Managing Director), Clerkenwell and Croydon.
George Template, Esq., Holborn Viaduct and Margate.
A. Compensation, Esq. (Chronometer Maker to the Royal Navy), Barbican and Westbourne Park.

BANKERS.

London & Westminster Bank (Limited), Lothbury.
The City Bank (Limited), Holborn Viaduct.

SOLICITORS.

Messrs. Knowlton, Sons, and Manderton, Clerkenwell.

BROKERS.

Messrs. A Parr & Co., Royal Exchange.

AUDITORS.

Messrs. Wider, Wake, & Co., Moorgate Street, E.C.

SECRETARY.

C. Hall Thayer, Esq.

CHIEF OFFICES.

Clerkenwell Road, London.

ABRIDGED PROSPECTUS.

This Company has been established in London for the purpose of manufacturing low-priced watches by machinery, in order to prevent the industry from losing its position among the staple trades of the country; for notwithstanding that the demand for English watches is steadily on the increase, the facilities afforded to foreign imitators of our work are so great, that capitalists have hitherto been disinclined to turn their attention in the direction of the watch trade.

The failure, however, of many of the speculative enterprises which were set on foot during the years 1881-82, together with the increasing disposition of the public to deal directly with the actual manufacturers in each special department of trade, has, in the opinion of the directors, given the new undertaking every prospect of success, and they believe that the business of the Company will only be limited by its powers of production.

Although the operations of the Company are intended to be kept prominently before the notice of the public, the directors are not desirous of assuming an antagonistic attitude towards retailers, who are invited to become shareholders, thereby securing proprietary rights, and participating in the well-known advantages of the co-operative system. The Company will invariably protect the interests of its agents, in addition to systematically advertising their businesses in their respective localities, as has long been the custom in other trades and manufactures.

It is from the foreign and colonial operations of the Company that the directors anticipate the most satisfactory results; the rapid colonisation of all parts of the globe is already bearing fruits in the shape of largely increased demands for the requirements of civilised life, among which watches are pre-eminent.

The claims which our rivals set forth for the superiority of their products on account of the improved system adopted by them, could only be met by similar enterprise on our own part, and the *modus operandi* has for years past engrossed the anxious attention of the most eminent men in the trade. Now that the undertaking has assumed its present dimensions, the directors have no doubt of its receiving support on national grounds alone.

The Buildings, Machinery, Stock, &c., may be inspected by special appointment, made with either the Secretary or the Managing Director.

Fifteen minutes after the perusal of this prospectus, our transatlantic visitor had presented himself at the Secretary's office, but was informed that the factory could not be inspected until the following day. In the meantime, a pamphlet was handed him, the contents of which will be given next month

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The Watch and Clock Makers' Pension Society.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—May I be permitted to bring the name and claims of this Society before the notice of your readers, in the hope that an increased list of subscribers will be the result.

As already announced in the May number of this Journal, I have been requested to undertake the duties of Treasurer, and am, therefore, specially interested in its success.

The Society was formed in 1817, for the purpose of relieving aged and necessitous workmen in the several branches of the trade, and their widows, by the grant of annual pensions, with a premium of 10 per cent. on all donations and subscriptions they may have paid into the Society; also medicines and medical attendance when necessary. The pensions are £21 for men, and £13 13s. for widows. The sum of £2 2s. at one payment constitutes a Life Subscriber, entitling to one vote at all elections. An annual subscription of 4s. entitles to one vote at all elections.

Owing, however, to the active competition of kindred charitable institutions, the Pension Society has not assumed those dimensions in the past that I trust it will in the future.

The Secretary, Mr. J. Jansen, 42, Spencer Street, E.C., and 29, Ambler Road, Finsbury Park, N., will be glad to receive subscriptions, and supply all necessary information.

Yours obediently,
JAMES U. POOLE.

33, Spencer Street, E.C.

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Messrs. R. Fletcher & Son, of 133, Upper Thames Street, London, E.C., and Kersley Paper Works, Stoneclough, near Manchester, have introduced a tissue paper admirably adapted for wrapping up jewellery, plate, watches, &c., as it is warranted to preserve these articles from tarnishing. Messrs. Elkington & Co. have used the paper for some time, and speak very well of it. (See testimonial appended to the advertisement on page xv.) A specimen of this tissue paper is enclosed with the supplements in this month's issue, and certainly deserves the serious attention of the trade.

The Worthies of Horology.

By C. Stuart Murray.

III.

LAST month, I left the reader feasting himself as at a banquet, with admiration of the wonderful clepsydra of Ctesibius, and looking at the first application of wheelwork to horology. The illustrations that were given in our last number were reduced from the form that the distinguished French architect, Claude Perrault, made from the text of Vitruvius, and such text is likely to be correct. We read that Vitruvius was a contemporary of Ctesibius, possibly an acquaintance; and, consequently, his ability and opportunity to give a true description of the wonderful machine that he saw may be relied on. His qualifications may be understood when I add that he was the most celebrated architect of his time, although we know very little of his private life; indeed, next to nothing.

But a classical friend, who has just looked in upon me, has put forth a strong claim for that great light of the ancient world, Archimedes, to be recorded as a Worthy of Horology. Now, as such friend helps me with translations, when such are required, I feel bound to examine the claim and ascertain upon what it is founded, premising that there has been more than one discussion about it, and that the presumption has been fairly accepted, that the great geometer must have invented some mechanical time-telling machine among his numerous engineering productions, which invention has not reached the modern ages.

Archimedes lived between the years 287 and 212 B.C., having come into the world about the time that Euclid—with whom all scientific horologists are acquainted—had departed from it. There was a "life" of him written by a contemporary, but it has been lost in the revolutions of the centuries, and civilisation is indebted for what is known about him to one of his commentators, and several other ancient classical writers. His works were collected and translated from the Greek, an edition having been published in Paris, in 1615, and another at the same place in 1809. In the present paper we have more—that is, my readers and myself—have more to do with the mechanical engineering of Archimedes, at least, so far as it seems to border upon clockwork, than with anything else about him. Our gold and silver-working friends have, no doubt, all heard of the famous crown of gold of king Hieron and the bath. I have, myself, read several accounts about it, but I am sorry to say that most of them have been so crippled, that is, so condensed in the telling, that the unfortunate reader has been more muddled at the end than he was at the beginning, so far as consecutive sense was concerned. Let me here try if I cannot improve upon this, by repeating, from the best sources extant, with, it may be, one or two explanatory notes of my own, with the view of making the matter as clear as I possibly can.

The story then is, that Archimedes was related to king Hieron, the second who sat upon the throne of Syracuse. Hieron had a son named Gelon, and when some authors have been unable to satisfy the tenderness of conscience that this crown was really Hieron's, they got over the doubt by giving it to Gelon; exactly as we, ourselves, do under similar circumstances upon the much-loved homely principle that "it is all in the family." In the course of time the king—Hieron or Gelon as you please—gave a certain weight of gold to a certain goldsmith to be made into a royal crown. It was duly finished, taken home, "weighed in" and "settled" for. So far so good. The question, however, arose in the king's mind as to whether or not he had had *all* his gold back? The crown weighed in all right so far as that went, but Hieron pushed the reasoning farther; namely, had the artist touched the melting-pot with anything in lieu of the gold; a "dash" of copper, for instance? There was no assaying, nor hall-marking that we read of being then in Syracuse. The matter preyed upon the mind of Hieron II., and as Archimedes was a kinsman of his, and known to be "deeply read in the stars," the learned man was soon in consultation about the crown. Without being able to arrive at any satisfactory conclusion, the solution of the troublous problem was ultimately left in the hands of the rising philosopher. To melt the crown would never do; consequently, the question was, how could any "ways that were dark" be found out without melting? The bath was a great institution among the ancient nations, even greater than with us, and, as a matter of course, Archimedes had his daily "tub" like other people. On a certain day, when stepping into the bath, he noticed that as each limb entered the water the fluid rose and flowed over; in other words, the idea occurred to him that his body and the water could not occupy the same space at the same time. Following this reasoning out, he was not long in coming to the conclusion that *bulk*, in combination with weight, was to form the standard by which he was to arrive at what he desired. As soon as this flashed across his mind he jumped out of the bath, and, all naked as he was, set off running through the streets at the top of his speed, exclaiming, "*Eureka! Eureka!* I have found it, I have found it!"

As the people thus beheld him, they called out to one another—"Has Archimedes gone mad?"

Having arrived at home and satisfied his household that he was in a state of sanity, he immediately set about the practical testing of his newly discovered theory.

As I am just now more particularly addressing a few by-words to the artists in the precious metals who read this journal, what I am about to say may instructively vary this paper by demonstration, thus. If a solid be placed in a vessel *filled* with water, so much of the water will overflow as the solid contains magnitude. Therefore, if the overflow can be measured, that measure will be the measure of the solid. Suppose, then, that the overflow ran into a tube whose internal capacity was one square inch, then every inch in height of the overflow would represent so many square inches of water, and, by a parity of reasoning, so many square inches of the solid that had caused the overflow. We can even prove this at the tea-table. Fill the tea-cup up to the brim as full as it will hold; then float the spoon upon it with the balancing of the fingers. The moment the spoon begins to sink, at the same moment will the tea begin to flow over into the saucer. If, instead of so flowing, what went into the saucer went into a measure, then the solid contents of the immersed spoon would be shown. This has to do with bulk alone, and it remains now to have the bulk, weight, and water displacement connected. The hydrostatic law is, "If two bodies have equal magnitude, their absolute weights will be in the same proportion as their specific gravities." The standard for specific gravity is distilled water at a given temperature, say 60 degrees. Taking, therefore, such water at the point of 100, gold will be 1,925, and copper 890. Supposing that 20 cubic inches of gold will weigh twenty times 1,925 = 38,500, and 7 cubic inches of copper will weigh seven times 890 = 6,230, then the 27 cubic inches of the compound will weigh 44,730, or one cubic inch 1,656⅔, whatever these numbers represent, whether grains or ounces. Therefore, the specific gravity of one cubic inch of the alloy is 1,656⅔. Now, the reader will easily comprehend why the cubic inch of gold at the specific gravity of 1,925 takes up only the same space as the cubic inch of the alloy, whose weight is but 1,656⅔. Consequently, to make a piece of the alloy weigh 1,925, it must be larger in size, and, therefore, take up more space and displace more water. For this demonstration, it is unnecessary to go into the difference between beaten metal and cast metal, as that will be readily understood. A cubic foot of pure gold weighs $1.203\frac{89}{100}$ lbs., or a little over half a ton, whilst a cube of six inches on each side would weigh $150\frac{3}{8}$ lbs.; that is, considerably over one cwt. and a quarter. In the face of these facts, it is somewhat amusing to hear people talk of the "sackfulls of sovereigns" that they could "sling" on their backs from the Bank of England, if they had the chance.

Having satisfied himself about the truth of his theorem, the philosopher lost no time in putting it into practice. Archimedes, therefore, caused to be fashioned for his purpose a bar of gold of the same weight and fineness as that from which the crown had been made, and a vessel to hold a quantity of water that could be accurately measured in its rising and its falling, to tell too surely whether or not "something was wrong."

It is recorded of King Hieron, that after the detection of the fraud—for it was detected—he could never refuse to believe anything that Archimedes told him. Such, good reader, such is the story plainly told of King Hieron's crown.

To the same famous philosopher, too, is attributed the well-known saying, "Give me a fulcrum, and I will make a lever that shall move the world." Of course, such an expression was only to be theoretically understood as intended to show that within practicable limits the power of the lever was omnipotent. He invented, also, an arrangement of pulley-tackle, by which he moved the Grecian ships. The celebrated "Screw of Archimedes." This was a kind of a huge solid corkscrew, fixed on the slope of about 45°, one end being in water, and the upper one attached to machinery. Its purpose was to raise water, more especially thick, muddy water, where other speedier means were not available. He invented it, when in Egypt, to clear low-lying lands after the subsidence of the overflowings of the Nile. It is stated that, by means of his many mechanical inventions, he held the land and sea forces of the Romans at bay for three years in the siege of Syracuse; the city was only ultimately taken through the negligence of the defenders. He had machines for throwing masses of stone and metal upon the assailants, chains for catching and overturning the enemy's ships, and other contrivances for setting the same ships on fire, and burning mirrors. He was the first and last of the ancients who in the theory of mechanics reduced things to demonstration from first principles; indeed, no further advance was made in that direction down to the time of Galileo.

He wrote seven books of mathematical work, and also constructed a machine for representing the motions of the sun, moon, stars, and "*perhaps* the planets." The ancients gave him credit for more than forty mechanical inventions, including his screw, and the application of its principle to the launching of the ships of that day, a hydraulic organ, and several mechanical toys. He made an instrument by which the diameter of the sun could be approximately measured. He squared the circle very closely, in which he showed that the ratio of the circumference to the diameter lay between 3·1428 and 3·1408. It is now known that the nearest is 3·1416. Besides all these works, he wrote two books on floating bodies, which contain, apart from algebra, all the conditions of a modern work on the same subject. I have read that Archimedes made a machine for measuring the hours of the day, but that the details of its construction have been lost. When we consider what he has written, and what he invented, all of a mathematical and engineering character, it seems next to impossible that he should have missed the timekeeper; therefore, we can the more readily believe that he intended such an instrument. I accept the statement that I have seen, and, consequently, record that Archimedes was an ancient worthy of Horology. He was killed by a Roman soldier, after the storming of Syracuse, the man not knowing who he was, as the orders of Marcellus, the general, were to save his life at any cost. He is stated to have been in his seventy-fifth year.

From that period we have to tread adown a long line of centuries, until we halt on the turbulent ground of historic disputation relating to horological machinery. Weidlen, in his History of Astronomy, places the invention of wheel-work clocks about the close of the 15th century, whilst Chambers, in 1751, tells us that the first clock was invented by one Boethius so far back as the year 510! But Mr. Derham goes even further than this, and speaks of the sphere of Archimedes, mentioned by Claudian, and that of Posidonius, spoken of by Cicero, as among the *machines* in use by the ancients for measuring the hours. Professor Hamberger read a paper before the Society of Göttingen, in the year 1758, which Professor Beckman, of the same University, managed to obtain and publish. A certain writer is said to have found mention made of a clock in the third century, and quotes the acts of St. Sebastian, the martyr, in support of what he says. One Chromatius was governor of Rome, and the Saint, it appears, was his "medical attendant." In one of these interviews, thus saith the governor, in the course of conversation (it is in Latin, but the following is the translation):—

"I have a glass chamber, in which the whole learning and science of the stars is constructed mechanically, in making which my father, Tarquinius, is known to have expended more than two hundred pounds of gold."

St. Sebastian answers:—"If you have made your choice to keep this whole, you destroy yourself."

To this Chromatius retorts:—"How so? Do we employ any sacrificial rights in the construction of an almanac or ephemeris, when merely the courses of the months and years are distinguished numerically for every hour; and the full and new moon is, by means of certain calculations, foreshown by a motion of the fingers."

The reader may construe this description, such as it is, either as that of a kind of clock, or some astronomical arrangement. The latter meaning would seem to be borne out by what St. Polycarpe is reported to have said about it.

"There are the signs of the Lion, of Capricorn, Sagittarius, Scorpio, and the Bull; in Aries the moon, in the Crab an hour, in Jupiter a star, in Mercury the tropics; in Venus, Mars, and in all those monstrous demons, is seen an art hostile to God."

But, whatever the machine was, the "Saints" took good care that it should not peril the souls of posterity, for they broke both it and its hostility to pieces, so that what its construction was like could never afterwards be ascertained; nor even who made it. Chambers is of opinion that these machines had their motive power from some arrangement of weights or springs, pullies and wheel work.

Following Hamberger, he speaks of a machine that was sent as a present from the King of Persia to Charlemagne, in 807, which was supposed to have been a clock in the modern sense of the term. Further investigation, however, showed that it was merely a curious form of clepsydra, having ingenious mechanism within it. After touching upon a number of writers, Professor Hamberger seems inclined to place the invention of automatic clocks about the early part of the eleventh century, and quotes authorities in support of his statement. Taking, for instance, the "Ancient Customs, &c., of the Monastery of St. Victor, at Paris," as follows:—

"The unequal hours then in use rendered this regulating of the horologia necessary. The days and the nights consisted of twelve hours each; but were sometimes shorter and sometimes longer." The reason of this "sometimes shorter, and sometimes longer," is thus explained in the above-mentioned customs:—"From the solstice of summer to the solstice of winter, the time-piece is regulated thus: as much as that space of night which precedes the matins gradually increases, according to the increments of the nights through the several months, it, slowly increasing, makes that space in the winter solstice which is before matins, to that which follows, twice. On the contrary, from the winter solstice to to that of spring it is thus regulated: it decreases that space which it had got in advance, according to the decrease of the nights through the several months, until, scarcely decreasing, it at length, in the summer solstice, passes over in the same time that space which is before matins and that which follows." Not only was the hour pointed out, but a sound of some kind was made at the same time. Calmet, in his Commentary, quotes from a book on the usages of the Cistercian monks, as compiled in the year 1120. "The bells will not be sounded for any service, not even for the clock, from the mass of Holy Thursday to that of Holy Saturday; and in Chap. 114, the sacristan is ordered to regulate the clock, that it may strike and wake him during winter before matins, or before the nocturns; and in Chaps. 68 and 114, that when the brethren have risen too early, the sacristan give notice to him who reads the last lesson to continue it until the clock strikes, or till signal be made to the reader to leave off." He read of the night-watch being ordered to "strike the clock and ring the bells to awake the sleeping brothers." Du Cange tells us of some one, deputed by the Superior, who had the care of the *striking clock*, struck it, and also carried light to all the cells.

Similar passages might be given from these sources, all tending to establish the fact that clocks really came into use about the eleventh century: furthermore, that they were, probably, invented and made by the monks themselves, and that they were the Horological Worthies of the middle ages. Curiously enough, however, intimations have been thrown out that the Saracens were the earliest clockmakers:—

"This conjecture is supported by the *horologium*, which, as Trithemius tells us, was sent by the Sultan of Egypt, in the year 1232, to the Emperor Frederick II. 'In the same year,' says he, 'the Saladin of Egypt sent by his ambassadors, as a gift to the Emperor Frederic, a valuable machine of wonderful construction, worth more than five thousand ducats. For it appeared to resemble internally a celestial globe in which figures of the sun, moon, and other planets, formed with the greatest skill, moved, being impelled by weights and wheels, so that performing their course in certain fixed intervals they pointed out the hour, night, and day, with infallible certainty; also the twelve signs of the Zodiac with certain appropriate characters, moved with the firmament, contained within themselves the course of the planets.'"

Here are some horological nuts to crack for my friends the clockmakers. They need not be afraid of them, for there are a few more remaining, quite as curious and interesting, which I hope to set before them next month.

(To be Continued.)

Mr. A. J. Mann covers objects manufactured from vegetable pulp with a metallic layer by the following process: The object to be covered is first impregnated with a watery extract of linseed. It is then treated with nitrate of silver and sulphuret of hydrogen, and finally covered with metal by the galvanic process.

Analysis of Native Alloys containing Gold, Silver, and Platinum.

By H. Bush, Hull.

The separation of different metals which are occasionally found combined by nature in the bosom of the earth, is owing to the different affinities which different metallic substances possess to certain bodies.

As these affinities are well known in chemistry, the analysis of a metallic compound, consisting of a variety of different metals, will become easy.

Suppose that a metallic mass was made up of platinum, gold, silver, bismuth, lead, iron, and copper, the separation can be effected in the following manner:

1st.—Let the alloy be divided by filing, or granulation, and digested in diluted nitric acid, till this agent exercises no further action on the residue. To be sure that the digestion of the soluble parts is completed, decant the acid from the residue and pour a small quantity of fresh acid on it, until all action ceases. The last acid is added to the former decantations, and the residue, which is the gold and platinum, are washed with a small quantity of lukewarm water, which is also added to the decanted acids.

2nd.—Pour quantities of cold water into the solution, until no further turbidness ensues. Let the precipitate, which is thus formed, subside and dry. This is the oxide of bismuth; 123 parts, when dry, are equal to 100 of metallic bismuth, or it may be reduced to its metallic state by mixing the dry precipitate with oil to the consistency of a thick paste, and fusing it briskly under a cover of charcoal dust.

3rd.—Concentrate the fluid from which the bismuth has been separated, by boiling to about half its volume, and immerse into it a clean copper plate, and the silver will flock on to the copper in a metallic state; wash the silver off the copper and immerse again until no more precipitate is formed. The silver may be dried and reduced by melting it with a little carbonate of soda.

4th.—To separate the lead, drop into the fluid of the last process sulphuric acid, till no further precipitate falls down. This precipitate is sulphate of lead; 100 parts of it, when perfectly dry, contain 30 of metallic lead.

5th.—The fluid from which the lead has been separated must now be mixed with liquid ammonia; a brown precipitate falls down, which is the iron that was contained in the alloy.

6th.—The solution from which the iron has been separated may be decomposed and freed from the remaining copper by mixing it with a saturated solution of potash and boiling it a little; the ammonia becomes volatilized, and an oxide of copper is precipitated. To obtain the copper in a metallic state, dissolve this oxide in muriatic acid, and dilute with an equal quantity of water; then immerse into it a clean iron plate, when the copper will adhere to it.

7th.—Having thus far proceeded, take the insoluble residue left in the first process and dissolve it in aqua-regia, a mixture of three parts of muriatic and one of nitric acid, till a complete solution is effected. Mingle this solution with a saturated solution of sal-ammoniac, and the platinum will become separated as a precipitate and leave the gold in the solution. The precipitated platinum is well washed and boiled in clean water to soak out the ammonia, and finally washed with alcohol, and is then ready to be welded to metallic state.

8th.—To recover the gold, mingle the remaining solution from which the platinum has been separated with a diluted solution of sulphate of iron, a precipitate falls down, which is metallic gold; collect and fuse it with a little borax into a solid mass. The analysis is now completed, and the combined weight of the obtained products will correspond with the weight of the substance submitted to examination, if the manipulation has been done carefully.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

*(Continued from page 178, Vol. VII.)**

The Standarding of Gold Bullion with Copper only is but rarely required by the working jeweller, as the colour of the metal is here of great importance; hence the alloy consists of Copper and Silver, and in some cases an addition of Brass in proportion to produce the desired Colour. The following mixtures will answer all ordinary purposes.

22 Carat Gold for Wedding Rings or Medals: 22 parts Fine Gold, 1 Fine Silver, 1 Copper.

18 Carat Bright Gold.

18 parts	Fine Gold	.. 4 Fine Silver	.. 2 Copper, or
18 ,,	Sovereign	.. 4 ,,	.. no ,,

18 Carat Coloured Gold.

18 ,,	Fine Gold	.. 4 Copper	.. 2 Silver, or
18 ,,	Sovereign	.. 2 ,,	.. 2 ,,

15 Carat Bright Gold.

15 ,,	Fine Gold	.. 6 Fine Silver	.. 3 Copper, or
15 ,,	Sovereign	.. 4⅔ ,,	.. 2⅓ ,, or
15 ,,	18 c. Bright Gold	2 ,,	.. 1 ,, or
15 ,,	18 c. Col. Gold	.. 2½ ,,	.. ½ ,,

15 Carat Coloured Gold.

15 ,,	Fine Gold	.. 6 Copper	.. 3 Fine Silver, or
15 ,,	Sovereign	.. 4⅔ ,,	.. 2⅓ ,, or
15 ,,	18 c. Col. Gold	.. 2 ,,	.. 1 ,, or
15 ,,	18 c. Bright Gold	2½ ,,	.. ½ ,,

12 Carat Gold.

12 ,,	Fine Gold	.. 8 Fine Silver	.. 4 Copper, or
12 ,,	Sovereign	.. 8 ,,	.. 2 ,, or
12 ,,	18 c. Col. Gold	.. 4 ,,	.. 2 ,, or
12 ,,	18 c. Bright Gold	3 ,,	.. 3 ,, or
12 ,,	15 c. Col. Gold	.. 2 ,,	.. 1 ,, or
12 ,,	15 c. Bright Gold	1½ ,,	.. 1½ ,,
3 ,,	Fine Gold	.. 12 parts of	9 carat Gold, or
3 ,,	Sovereign	.. 10 ,,	9 ,, or
3 ,,	18 c. Col. Gold	.. 6 ,,	9 ,, or
3 ,,	15 c. ,,	.. 3 ,,	9 ,,

9 Carat Gold.

9 ,,	Fine Gold	.. 8 Fine Silver	.. 7 Copper, or	
9 ,,	,,	.. 7 ,,	.. 5 ,,	.. 3 Brass, or
9 ,,	Sovereign	.. 8 ,,	.. 5 ,,	.. no ,,
9 ,,	,,	.. 6½ ,,	.. 4½ ,,	.. 2 ,,
9 ,,	18 c. Col. Gold	.. 6 ,,	.. 3 ,,	.. no ,,
9 ,,	18 c. ,,	.. 5 ,,	.. 2 ,,	.. 2 ,,
9 ,,	18 c. Bright Gold	5 ,,	.. 4 ,,	.. no ,,
9 ,,	15 c. Col. ,,	.. 4 ,,	.. 2 ,,	.. no ,,
9 ,,	15 c. Col. ,,	.. 3 ,,	.. 1 ,,	.. 2 ,,
9 ,,	15 c. Bright Gold	3 ,,	.. 3 ,,	.. no ,,
9 ,,	12 c. Gold	.. 1 ,,	.. 1 ,,	.. 1 ,,

A very handsome colour of 9 carat Gold is produced of 9 parts of 15 carat Coloured Gold and 6 Brass; it is, however, more liable to tarnish than the other alloys. Plates of old English watch-movements are a suitable brass for alloying 9 carat Gold.

The 9 carat Gold, alloyed with Brass, requires some care in working; it must oftener, and not too hot, be annealed; allowed gradually to cool near the fire, not be quenched in water or placed in a cold place immediately after annealing. If these precautions are not observed, it is liable to crack and split in a peculiar manner.

Table for converting the oz., dwt., and grain weight into Decimals.

1 ounce	=	1·000 oz.	4 dwts.	=	·200 oz.	11 grains	=	·023 oz.
19 dwts.	=	·950 ,,	3 ,,	=	·150 ,,	10 ,,	=	·021 ,,
18 ,,	=	·900 ,,	2 ,,	=	·100 ,,	9 ,,	=	·019 ,,
17 ,,	=	·850 ,,	1 ,,	=	·050 ,,	8 ,,	=	·017 ,,
16 ,,	=	·800 ,,	23 grains	=	·048 ,,	7 ,,	=	·015 ,,
15 ,,	=	·750 ,,	22 ,,	=	·046 ,,	6 ,,	=	·013 ,,
14 ,,	=	·700 ,,	21 ,,	=	·044 ,,	5 ,,	=	·010 ,,
13 ,,	=	·650 ,,	20 ,,	=	·042 ,,	4 ,,	=	·008 ,,
12 ,,	=	·600 ,,	19 ,,	=	·040 ,,	3 ,,	=	·006 ,,
11 ,,	=	·550 ,,	18 ,,	=	·038 ,,	2 ,,	=	·004 ,,
10 ,,	=	·500 ,,	17 ,,	=	·035 ,,	1 ,,	=	·002 ,,
9 ,,	=	·450 ,,	16 ,,	=	·033 ,,	⅞ ,,	=	·0018 ,,
8 ,,	=	·400 ,,	15 ,,	=	·031 ,,	¾ ,,	=	·0015 ,,
7 ,,	=	·350 ,,	14 ,,	=	·029 ,,	½ ,,	=	·001 ,,
6 ,,	=	·300 ,,	13 ,,	=	·027 ,,	¼ ,,	=	·0005 ,,
5 ,,	=	·250 ,,	12 ,,	=	·025 ,,	⅛ ,,	=	·0002 ,,

Table for converting Decimal Weight into oz., dwts., and grains.

1·000 oz. equal to 1 ounce.

·95 oz.	=	19 dwts.	·35 oz.	=	7 dwts.	·03 oz.	=	14½ gr.
·9 ,,	=	18 ,,	·3 ,,	=	6 ,,	·02 ,,	=	9½ ,,
·85 ,,	=	17 ,,	·25 ,,	=	5 ,,	·01 ,,	=	4¾ ,,
·8 ,,	=	16 ,,	·2 ,,	=	4 ,,	.009 ,,	=	4¼ ,,
·75 ,,	=	15 ,,	·15 ,,	=	3 ,,	·008 ,,	=	3¾ ,,
·7 ,,	=	14 ,,	·1 ,,	=	2 ,,	·007 ,,	=	3¼ ,,
·65 ,,	=	13 ,,	·09 ,,	=	1 dwt. 19¼gr.	·006 ,,	=	3 ,,
·6 ,,	=	12 ,,	·08 ,,	=	1 ,, 14½ ,,	·005 ,,	=	2½ ,,
·55 ,,	=	11 ,,	·07 ,,	=	1 ,, 9½ ,,	·004 ,,	=	2 ,,
·5 ,,	=	10 ,,	·06 ,,	=	1 ,, 4¾ ,,	·003 ,,	=	1½ ,,
·45 ,,	=	9 ,,	·05 ,,	=	1 ,, 0 ,,	·002 ,,	=	1 ,,
·4 ,,	=	8 ,,	·04 ,,	=	0 ,, 19¼ ,,	·001 ,,	=	½ ,,

The smaller divisions of the Old Troy Weight do not fully convert into Decimals; whereas dwts. afford exact equivalents, grains do not approximate to it, as ½ grain cannot be brought nearer than ·001 $\frac{1}{24}$, and every grain in proportion up to 12 grains, when the fractions amount to ·001, which is added to make the equivalent of ·025, and then the same dissimilarity continues up to 1 dwt., when another ·001 has accumulated to give the equivalent of ·05 oz.

Any of the noughts to the right side of a decimal may be detached without altering its actual value, for ·700 are equal to ·70 or ·7 in amount, but merely alter the expression of denomination, whilst ·700 are expressed as $\frac{700}{1000}$; ·70 are $\frac{70}{100}$, and ·7 are $\frac{7}{10}$; ·350 are equal to ·35, and so in every one of these instances; the noughts to the *left* side of a decimal denote its value, and must be left standing in every instance; as ·07 are $\frac{7}{100}$, ·007 are $\frac{7}{1000}$, ·0007 are $\frac{7}{10000}$, ·00007 are $\frac{7}{100000}$, and ·000007 are $\frac{7}{1000000}$. In the summing up of an aggregation of weights, the inexperienced calculator will find it safer to give all weights the denomination of the one having the most figures; for instance, we have to find the aggregate weight of

·352		·352
·17	we fill in noughts as	·170
·9		·900
1·422		1·422

which may tend to prevent mistakes in reckoning.

Fine contents of the various Gold Standards, and value of the divisions of old Troy and Decimal weights.

Value of 24 carat or Fine Gold without Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/000 oz.
£4 5s.	4s. 3d.	2⅛d.	8s. 6d.	10¼d.	1d.

1 oz. 22 carat Gold (English Coin Standard) contains 18 dwts. 8 grs. = ·916⅔ oz. Fine Gold.

Value per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£3 17s. 11d.	3s. 10¾d.	2d.	7s. 9½d.	9¼d.	1d.

Price of 22 carat Gold, including Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£3 18s. 9d.	3s. 11¼d.	2d.	7s. 10½d.	9½d.	1d.

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* Errata.—On page 177, second column, in last month's issue, in "Example for Silver Bullion," after the item 353 ozs. 12 dwts. reported *Better*, 6½ dwts., *for* 431½ dwts. Fine Contents, *read* 457½ dwts., and multiply the above amount with the corrected fine contents.

1 oz. 21⅗ carat Gold (French, German, and American Coin Standard) contains 18 dwts. = ·900 oz. Fine Gold.

Value per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£3 16s. 6d.	3s. 10d.	1¾d.	7s. 8d.	9d.	0¾d.

Price of 21⅗ carat Gold, including Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£3 17s. 6d.	3s. 10½d.	2d.	7s. 9d.	9¼d.	1d.

---

1 oz. 18 carat Gold contains 15 dwts. = ·750 oz. Fine Gold.

Value per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£3 3s. 9d.	3s. 2¼d.	1½d.	6s. 4½d.	7½d.	0¾d.

Price of 18 carat Gold, including Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£3 5s.	3s. 3d.	1¾d.	6s. 6d.	7¾d.	0⅜d.

---

1 oz. 15 carat Gold contains 12 dwts. 12 grs. = ·625 oz. Fine Gold.

Value per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£2 13s. 1½d.	2s. 7¾d.	1¼d.	5s. 3¾d.	6¼d.	0½d.

Price of 15 carat Gold, including Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£2 14s. 6d.	2s. 8¾d.	1½d.	5s. 5¾d.	6½d.	0½d.

---

1 oz. 12 carat Gold contains 10 dwts. = ·500 oz. Fine Gold.

Value per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£2 2s. 6d.	2s. 1½d.	1d.	4s. 4d.	5¼d.	0½d.

Price of 12 carat Gold, including Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£2 4s.	2s. 2½d.	1d.	4s. 5d.	3⅜d.	0½d.

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1 oz. 9 carat Gold contains 7 dwts. 12 grs. = ·375 oz. Fine Gold.

Value per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£1 11s. 10½d.	1s. 7d.	0¾d.	3s. 2¼d.	3¾d.	0⅜d.

Price of 9 carat Gold including Alloy.

Per oz.	dwt.	grain.	1/10 oz.	1/100 oz.	1/1000 oz.
£1 13s. 6d.	1s. 8d.	0¾d.	3s. 4¼d.	4d.	0½d.

Rates of Charges for Hall-marking Wrought Gold and Silver articles liable to Duty.

Gold, not exceeding	s.	d.	Silver, not exceeding	s.	d.
1 ounce = 1·000 oz. ..	17	0	1 ounce = 1·000 oz. ..	1	6
19 dwts. = ·95 ,, ...	16	2	19 dwts. = ·95 ,, ...	1	5
18 ,, = ·9 ,, ...	15	4	18 ,, = ·9 ,, ...	1	4
17 ,, = ·85 ,, ...	14	5	17 ,, = ·85 ,, ...	1	3½
16 ,, = ·8 ,, ...	13	7	16 ,, = ·8 ,, ...	1	2½
15 ,, = ·75 ,, ...	12	9	15 ,, = ·75 ,, ...	1	1½
14 ,, = ·7 ,, ...	11	11	14 ,, = ·7 ,, ...	1	0½
13 ,, = ·65 ,, ...	11	1	13 ,, = ·65 ,, ...	0	11½
12 ,, = ·6 ,, ...	10	2	12 ,, = ·6 ,, ...	0	11
11 ,, = ·55 ,, ...	9	4	11 ,, = ·55 ,, ...	0	10
10 ,, = ·5 ,, ..	8	6	10 ,, = ·5 ,, . ..	0	9
9 ,, = ·45 ,, ..	7	8	9 ,, = ·45 ,, ..	0	8
8 ,, = ·4 ,, ...	6	10	8 ,, = ·4 ,, ...	0	7
7 ,, = ·35 ,, ...	5	11	7 ,, = ·35 ,, ..	0	6½
6 ,, = ·3 ,, ..	5	1	6 ,, = ·3 ,, ..	0	5½
5 ,, = ·25 ,, ...	4	3	5 ,, = ·25 ,, .. .	0	4½
4 ,, = ·2 ,, ...	3	5	4 ,, = ·2 ,, ...	0	3½
3 ,, = ·15 ,, ...	2	7	3 ,, = ·15 ,, ...	0	2½
2 ,, = ·1 ,, ...	1	8	2 ,, = ·1 ,, ...	0	2
1 ,, = ·05 ,, ...	0	10	1 ,, = ·05 ,, ...	0	1

One sixth part of the Duty is allowed on gold and silver articles, when sent in an unfinished state to be Hall-marked. If an article weighs one ounce, take off the sixth part of the amount of Duty; if it weighs six ounces, you only pay for five, and so in proportion for any number of ounces or pennyweights of *Silver* articles; *Gold* articles are entitled to the deduction if the aggregate weight exceeds an ounce, the pennyweight paying according to the table.

Diamond Weights expressed in Decimals.

151½	carats	=	1 ounce.	7 carats	=	·046204 oz.
150	,,	=	·990099 oz.	6 ,,	=	·039603 ,,
100	,,	=	·660066 ,,	5 ,,	=	·033003 ,,
90	,,	=	·594050 ,,	4 ,,	=	·026402 ,,
80	,,	=	·528052 ,,	3 ,,	=	·019801 ,,
70	,,	=	·462046 ,,	2 ,,	=	·013201 ,,
60	,,	=	·396039 ,,	4 grains, or 1 carat	=	·006600 ,,
50	,,	=	·330033 ,,	3 ,, or ¾ ,,	=	·004950 ,,
40	,,	=	·264026 ,,	2 ,, or ½ ,,	=	·003300 ,,
30	,,	=	·198019 ,,	1 ,, or ¼ ,,	=	·001650 ,,
20	,,	=	·132013 ,,	⅛ ,,	=	·000825 ,,
10	,,	=	·066006 ,,	1/16 ,,	=	·000412 ,,
9	,,	=	·059405 ,,	1/32 ,,	=	·000206 ,,
8	,,	=	·052805 ,,	1/64 ,,	=	·000103 ,,

The nearest approximation of the carat to the decimal weight is 151½ Carats to the Ounce; leaving, however, an infinitesimal difference, which does not affect the value of even so expensive articles as Diamonds.

The Millionth decimals may, for convenience and practical use, be converted into Thousandths or Ten-Thousandths by detaching two or three figures to the right side of the Decimal, especially if the first of the detached figures is a nought or one of the smaller figures, as in the following instances:

1/64 car. = ·0001 oz., 1 car. = ·0066 oz., 8 car. = ·0528 oz., 10 car. = ·066 oz., 30 car. = ·198 oz., 100 car. = ·66 oz., 1000 car. = 6·6 oz.

With the assistance of the above tables, aggregate quantities of Diamonds, weighed by the carat, can be very closely approximated to the decimal weight; and in computing larger quantities, it is advisable to take the equivalents in full Millionth decimals for each stone or parcel, and after the addition of the equivalents the total weight may be expressed in a more convenient decimal, by detaching two or three figures from the right side of the aggregated decimals, viz:—

A parcel of Diamonds consists of the following smaller parcels or single stones.

100		carats	=	·660066.
80		,,	=	·528052.
4		,,	=	·026402.
50		,,	=	·330033.
2		,,	=	·013201.
30		,,	=	·198019.
1		,,	=	·006600.
¼	= $\frac{16}{64}$	,,	=	·001650.
1/16	= $\frac{4}{64}$	,,	=	·000412.
1/64	= $\frac{1}{64}$	,,	=	·000103.
267 $\frac{21}{64}$		Carat	=	1·764538 oz.

If, for obtaining a more convenient decimal in this example, the two last figures 38 are detached, it will be ·7645 oz., or a small difference of 38 Millionth ($\frac{38}{1000000}$) of an ounce, an equivalent of about one third (1/3) of one sixty-fourth (1/64) of a carat.

(*To be Continued.*)

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IMPORTANT NOTICE.

WANTED, a TEACHER for the Silversmiths' Technical Class, established by the Young Mens' Christian Institute, and to be held at the Polytechnic, Regent Street. For all particulars, apply to Robert Mitchell, Esq., *Sec.*, Young Mens' Christian Institute, 48 & 49, Long Acre, London, W.C.

The Pallet and Pinion Controversy in the "British Horological Journal."

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Will you kindly grant me space for a few observations, in reference to a letter by Mr. Gardner, in the June number of the *British Horological Journal*, in which my name occurs repeatedly. That letter (which appears with an untruth on the face of it, because the writer had advertised his former as the final one) is written on pretext of continuing a technical discussion, but apparently its object is "Abuse."

He charges me with "gulling the reader," or the only alternative, "ignorance of the figures I used."

There is, however, this advantage about the general character of this epistle; its style is that of persons who get the shady side of an argument, and who then use abuse to cover their weak points.

The personalities Mr. Gardner indulges in, and to which the *British Horological Journal* lends itself, to give them publicity, would not be used, nor allowed, in a third-class discussion society; and that the Editor should stoop to the quotation of that worn out "mimicry" of a foreigner's rendering of the term "little"—"leetle," is certainly surprising.

The author and his publisher may have to learn that Newton's third Law of Motion has its application in morals as well as in matter; hence I should confidently leave the matter to the judgment of the majority of its readers, were it not that the whole fabric of abuse was placed on misconstruction of parts of my letter of May last.

Now, as to Mr. Gardner's proof of my "gulling the reader," or of my ignorance of the figures I have given. After quoting from my letter in the May number, he says (page 137), following his statement about my "gulling," &c., "and finds the value of the wheel angle to be

$$1^\circ\ 40'.$$

I should think it would be expressed by

$$\tfrac{17}{10}{}^\circ = 1^\circ\ 42'.$$

As the rest of his communication (referring to my letter in the May number) hangs on this, comment is needless."

It is, then, on the quotations from my letter, which precedes the above remark of Mr. Gardner, that he bases the charge against me of "gulling the reader," which he professes to have demonstrated by his rendering of the formula.

$$\tfrac{17}{10}{}^\circ = 1^\circ 42'.$$

This formula is derived from the proportion

$$10 : 1 :: 17^\circ :: 1^\circ\ 42^\circ.$$

$$\text{hence}\quad \tfrac{17}{10}{}^\circ = 1^\circ\ 42'$$

according to his showing.

But this has reference to an oblique angled triangle, of which the line of centres is the base, the pinion radius of contact one side, and the wheel radius of contact the other.

Now, in oblique angled triangles, the sides are proportioned to the sines of the opposite angles; hence, the proportion should read thus:—

$$10 : 1 :: \text{Sine } 17^\circ : \text{Sine } x.$$

where x is the angle to be found.

Hence, if Mr. Gardner would have "thought" to say

$$\frac{\text{Sine } 17^\circ,}{10.}$$

instead of $\tfrac{17}{10}{}^\circ$, he would have been nearer the truth.

$$\text{But}\ \frac{\text{Sine } 17^\circ}{10} = \cdot 29\tfrac{23}{10}72 = \cdot 0292372 = \text{Sine } 1^\circ\ 40'$$

and this is the value I have given.

But as this is "the point the whole hangs on," I ask, who has been "gulling" the reader?

But yet another word about this "gulling formula" that I have used.

In the triangle in question, only the base, one side, and one angle are known; therefore, if Mr. Gardner's formula was right it would not be applicable, because it assumes both sides to be known, which is not the case.

The known angle is contained by the base and the known side; hence, the opposite angle is found in terms of the tangent, which is the quotient of the sine, divided by the base, minus the cosine, or as I have rendered it (page 122)

$$= \text{Log. Sine } 17^\circ - (\text{Log. } 11 - \text{Cosine } 17^\circ) = \text{tangent } 1^\circ\ 40'$$

which is the same, as

$$\frac{\text{Sine } 17^\circ}{10} = 1^\circ\ 40'.$$

If any reader will take the trouble to refer to definitions of oblique angled triangles, in any work on Trigonometry, he can verify either mine or Mr. Gardner's rendering, which will also give an answer to his advertisement about my "ignorance," &c. *

So much then, for the peg on which Mr. Gardner has hung all the abuse.

In reference to what he has said in the opening of his letter, I refer the reader to page 164, Volume VI., of the *Watchmaker, Jeweller, & Silversmith*, or, better still, to "Saunier," Plate XIV., Fig. 2. I had simply engaged to show that an angle of 17° was not possible.

After the praise Mr. Gardner has bestowed on M. Schouffelberger, I can only conclude, that his quotation, side by side with mine, is a mistake; because since the results are practically identical, it appears just the opposite to what Mr. Gardner wanted to show. What he has said about my "Business," in the opening of his letter, is a piece of impudence, like his letter in the October number of the *British Horological Journal*, about the Horological School of Geneva, and about as true.

In reference to what Mr. Gardner says, as regards coefficients of depthing, I beg to state that I could quote my own words on this from the American *Horological Journal* years ago. I am only waiting a more favourable turn of the Patent Law to bring out both tables and a machine for planting, that has the advantage of any tool I have yet seen or heard of.

About the question of pallets, I will send you an "analysis" as soon as I conveniently can.

Yours, &c.,

Lordship Lane, Dulwich. **I. HERRMANN.**

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* Since the above was written, another letter has appeared, by the same author, on this point in the *British Horological Journal* for July. He evidently saw the "Peg" was very shaky, and so he has hung his insinuations on to another one; but I think Mr. Schoof has loosened this one too. No one who knows Mr. Schoof will attribute his opinion to "insufficient experience on gearing." Mr. Gardner's last tactic is somewhat like that of an Indian, who, when his geographical theory as to seven different oceans, composed of salt water, milk, toddy, &c., is confronted by the argument that British sailors have been all over the world, but never found any ocean of milk, &c., replied gravely, "This only shows that your sailors have never yet been out of salt water."

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 140, Vol. VII.)

> "I think the introduction of the keyless watch, and consequent adoption of the going barrel, the greatest misfortune the English watch trade has met with in my time. I still think the Fusee is in every way the thing for even middling class watches."—David Glasgow.

KEYLESS WORK.

IN proposing a vote of thanks to the Cantor lecturer, at the Society of Arts in February, 1881, Mr. Glasgow employed similar language to the above, when he referred to the present and future of the English watch trade, adding his conviction "that the British public will yet wake up and say we are right after all." On hearing this, the chairman showed signs of impatience, and he (Mr. Glasgow), amid general disapprobation, speedily brought to a close a short and discursive speech, which, twenty-five years ago, would have met with marked approbation by the trade, but is now regarded in the fading light of the lay of the last minstrel.

It is a generally received opinion that "when the doctors differ the patient is sure to die"—if not from the malignity of his disease, he is in great danger of becoming a victim to their violent treatment. I regret to think the same maxim holds good with regard to the horological doctors, and perhaps there are few things of late years that have done more to retard the progress of English horology, than our unhappy difference of opinion on the subject we are about to consider; and if you ask me for the brightest and most hopeful sign in our business to-day, I point to the undoubted fact that opposition to going barrel keyless work has practically ceased, and that we are now attempting to make the very watch we have so long despised; and though to some it may seem incredible, yet it is true, that while there has been an almost unlimited demand for key and keyless going barrel watches, we have been endeavouring to force upon the market what the people will never have—a thick, ugly fusee key watch, and most English watch manufacturers are now paying the penalty for neglecting the day of opportunity. However much we may be disposed to dispute as to which is the best way to make a watch, I suppose there will be few who will contend against making a watch which everybody is prepared to purchase. Sir John Bennett is quite right when he says the *first* question in watchmaking is *what to make*; the second question is, how to make it.

In going barrel keyless work we enter the region of complicated work, and it will be necessary to define the limits to which we can go in making complicated watches, because we shall presently have to consider a system of manufacture that applies to large quantities; we must therefore think of those things which tend to uniformity, not nonconformity; of unity—and not adversity. If watch manufacturing meant model making (*i.e.*, every watch different), then our system in Clerkenwell would be perfect, it would leave nothing to be desired; it is specially adapted to making complicated watches, of which only very few are required in the market. Hence our chief feature is "many variations of style," and every little maker fiercely contends that his specialty is best. Instead of glorying in this feature, which is really the cause of much of our weakness and reproach, we must seek for essential unity in existing diversity; and he who reduces to order this chaos, shall do no mean service to English horology.

Now, the extent to which we can at present go in making complicated work is a *centre seconds keyless chronograph.* For this watch there is already a large and increasing demand, and if it be possible to simplify its construction, so as to bring it under the denomination—low-priced, the trade in this watch is capable of indefinite extension. But when we make a clock-watch that combines perpetual calendar, keyless and minute repeating work, with independent centre seconds chronograph work, we make a watch that, like an army in mutiny, is not calculated to make many victories; one part destroys the other, and it is more fitted for the cabinet of a connoisseur than for the business of life; and while we greatly admire the genius that produces such work, we greatly regret that better employment cannot be found for men of such abilities. With the same amount of engineering skill required to make a watch of this kind, we shall tunnel the Channel from Dover to Calais, we shall utilise the Falls of Niagara, and illuminate and ventilate the darkest recesses of Mammoth Cave. We would rather see the hero of the Suez Canal engaged in perforating the Isthmus of Panama, than we would see him employed in perfecting a perpetual calendar on a pipeing bullfinch. In short, we must not waste time on unworthy objects; what we have said on the extreme low-priced work of Switzerland, is equally true of their complicated work; they are heartily welcome, both to the profit and to the reputation they can make by such watches.

The going barrel keyless work generally adopted in this country, is that known as the rocking or shifting bar mechanism. It is preferred to that known as the rod mechanism, generally adopted in Switzerland, because of the fewness of its parts. In considering the objection so frequently urged against this mechanism, I may correct the mistake of one author and the petulance of another. Mr. Grossmann says, "The size of teeth is, with the keyless mechanisms of the rocking bar category, essentially prescribed by the toothing of the motion work." This is a mistake; the teeth are not by this mechanism essentially prescribed by the teeth of motion work; *e. g.*, suppose very strong teeth are desired for the keyless work, take a

Canon pinion	10
Minute wheel	20
Minute wheel pinion	10
Hour wheel	60

Make the motion wheels as large as the movement will allow, and the keyless wheels which gear with the minute wheel will be of great strength. The hour wheel, being a high number, will have little side shake, which is desirable.

Mr. Poole says (p. 38, Vol. VII.), "At one time the teeth for keyless wheels were preferred coarse, but it has been proved that fine teeth are equally as strong, if properly pitched and sectored, while they undoubtedly give a safer click action." This statement is altogether erroneous; nothing of the kind has ever been proved.

There is room for improvement in the arrangement for setting the hands; all systems in use at the present time are more or less defective. What is wanted is a combination that will compass the requirements of Mr. Grossmann's proposition. He says, "I have always thought the setting hands mechanism ought to be constructed in such a way that—1st, the motion wheels can never come in contact with the keyless wheels by any accidental cause; on the contrary, they should be so arranged as to require a decided act on the part of the wearer to establish their connection with the motion work. 2nd, after having set the hands, the said mechanism ought to go out of gear with the minute wheel by its own action, and without requiring any care whatever on the part of the wearer. These two principles are of the utmost importance to the good and reliable service of the watch, for a watch invariably stops if the keyless mechanism comes into or remains in gear with the motion work at the wrong time; and a construction which requires a degree of care which not all wearers bestow on their watches must be called defective, so long as other constructions may be attained without this weak point. If these words were all that Mr. Grossman had ever written, they would be sufficient to establish his reputation as a great watchmaker; because they more thoroughly comprehend the entire subject than anything else yet written upon it, and are, doubtless, the result of much careful and thoughtful observation, and therefore worthy of the most careful consideration of those inventors whose attention is directed to improvements in the keyless mechanism. Let us examine existing keyless mechanism by this test, and I fear we shall not find one that can be said to be mechanically perfect. We will begin at home. The hand-setting arrangement generally adopted in this country is by a push piece fitted into a pipe which projects through the middle or band of the case; formerly they were made so that the pipe did not project through the case. This arrangement was intolerable, the hands were so frequently shifted that it could not be depended upon for a single day. The pipe which projects through the band and covers the push-piece greatly diminishes the liability to accidental setting, but does not entirely do away with it, for the notch by which the push-piece is pressed down under unfavourable circumstances becomes a channel by which accidental shifting of the hands may be more effectually accomplished. The pipe is not only unsightly, it is unsound. Hand-setting arrangements of this category are opposed to the first part of Mr. Grossmann's proposition.

Richard Whittaker.

(To be continued.)

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

(*Continued from page* 182.)

XXXVII.

Thick Platinum Electro-Deposits.—Fill a glass flask with ⅓ of an ounce of finely-laminated spongy or black platinum, and a mixture of 5⅓ oz. of hydrochloric acid, and 3½ oz. of nitric acid at 40° Baumé. Place the flask upon a piece of sheet iron perforated in the centre, so that the bottom of the flask alone receives the heat. After an abundant production of orange yellow fumes the platinum will disappear and leave a red liquid, which should be heated until it becomes viscous enough to stick against the sides of the flask. This latter part of the operation may be effected in a porcelain dish, the shallow form of which aids in the evaporation of the acids in excess. After cooling, the residuum is dissolved in 17 oz. of distilled water, and filtered if necessary.

Dissolve 3½ oz. of phosphate of ammonia in 17½ oz. of distilled water, and mix the two solutions. This produces a precipitate of phosphate of ammonia and platinum in a liquid of orange colour, which should not be separated; pour into it, stirring all the while, another solution of 17½ oz. of phosphate of soda in 1¾ pint of distilled water. Boil the mixture, and replace the evaporated water, until no more ammonia is disengaged, which is ascertained by the smell; and until the liquor, which was previously alkaline, begins to redden blue litmus paper. When the yellow liquor becomes colourless, it indicates the formation of a double platinum salt. The bath is then ready to deposit platinum upon articles of copper or its alloys, by the aid of heat and of an intense electric current. Copper coated with platinum resists nitric and sulphuric acids to a considerable extent. If iron, zinc, lead, or tin come in contact with the bath they will decompose it, and the metal deposited will be black. The dead lustre of platinum is pearl-grey; it is very hard, and cannot be brightened by scratch-brushes of brass, which render its surface yellow; powdered pumice-stone or iron wires should be employed. Platinum deposits may be burnished by an energetic friction, and the lustre obtained is very durable. Platinum may be removed from copper by a very long immersion in the liquors given for ungilding, but the success is doubtful.

Nickel Deposits.—Nickel deposited by the wet way is white, with a slightly yellow tinge, having a dull pearl-grey dead lustre; it is obtained by dissolving the nitrate of nickel in its own weight of ammonia, and diluting the whole with twenty or thirty times its volume of liquid bisulphite of soda, marking about 24° Baumé. This application is found useful when articles require to be protected against the oxidising action of damp or salt air, sulphurous gases, and weak acids. Nickel electrotypes stand the wear and tear caused by ink, and press much better than the ordinary copper ones. Another bath is a solution of nitrate of nickel, without excess of acid, precipitated by cyanide of potassium, and the precipitate re-dissolved by more cyanide. An acid solution of nickel may be precipitated by alkalies, such as potash, soda, or ammonia; after washing the precipitate, dissolve in cyanide of potassium. A moderate battery power and nickel anodes are employed.

Nickel Plating without a Battery.—Into the plating vessel, which may be of porcelain or copper, place a concentrated solution of zinc chloride, dilute it with from one to two volumes of water, and heat to boiling. If any precipitate separates, it is to be re-dissolved by adding a few drops of hydrochloric acid. As much powdered zinc as can be taken on the point of a knife is thrown in, which covers the vessel internally with a coating of zinc. The nickel salt, for which purpose either the chloride or sulphate may be used, is added until the liquid is distinctly green; then put in the articles to be plated, previously thoroughly cleaned, together with some zinc fragments. Continue the boiling for fifteen minutes, when the coating of nickel is completed. Well wash the articles with water, and clean with chalk. If a thicker coating is desired, the operation may be repeated. Wrought and cast iron, steel, copper, brass, zinc, and lead have been successfully coated by this process. It is necessary that the objects should be entirely covered by the plating liquid, and that their surfaces should be thoroughly cleaned. Salts of cobalt, treated in the same manner, afford a cobalt plating, which is steel grey in colour, not so lustrous as the nickel, and more liable to tarnish.

Zinc Deposits.—Zinc is deposited by the wet way and by the battery. The dead lustre colour is a grey bluish-white. Precipitate a soluble zinc salt by ammonia; this precipitate re-dissolved in an excess of alkali gives a satisfactory bath; any kind of zinc salt may also be dissolved in cyanide of potassium or a soluble sulphite. These deposits are entirely different as regards the durability, from the so-called galvanising; when cleansed iron is plunged into a bath of molten zinc, and is thus protected against oxidisation for a long time, which is not the case with electro-deposi zinc. For depositing upon copper or brass, in the wet way, prepare finely-divided zinc, by pouring the molten metal into a previously strongly-heated iron mortar, and stirring until nearly cold. The powdered zinc thus obtained is placed in a porcelain vessel, and to it is added a concentrated solution of sal ammoniac. This mixture is heated to boiling, and the copper or brass objects to be coated with zinc, but previously well cleansed, even with an acid, are then placed in a liquid where they obtain a brilliantly white adhering layer of zinc.

(To be continued).

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 143.)

Benvenuto Cellini (1500—1571) was, without doubt, the greatest Florentine metal-worker of his time, although it is probable that some less boastful artists, as Caradozzo, of Milan, may have been his equals in manipulative skill, and, perhaps, his superiors in design. His earlier years were chiefly devoted to goldsmith's work in Rome and Florence. Subsequently he went to Paris. The known works left by him are few, his bronzes being the most important. Of these, the earliest executed is the bas-relief representing the "Nymph of Fontainebleau," an ideal embodiment of the spring known as the "Belle Eau," in that forest.

The nude recumbent female resting upon a vase, whence issues the pure element from which surrounding animals hasten to drink, is a mannered figure of overstrained grace, and but ill-proportioned; in workmanship, highly elaborated (a cast is in the South Kensington Museum, No. 64—104). It was made in semi-circular form, to be placed over the great door of the Palace, and is now in the Louvre. His next bronze, the highly-wrought but startling bust of Duke Cosinio, executed in 1546, is at Florence, in the Borgello. Meanwhile, he was occupied in preparing for his greatest work, the group of Perseus and Medusa, the original wax model of which is also preserved in the Borgello.

Having made the fallow body of Medusa in a separate piece, he built up the figure of the Perseus to be cast in one jet. The furnace prepared, and all in readiness, his ten or more assistants all at hand, the excitable and anxious artist, overcome by fatigue, was prostrate by fever at the critical time. But Cellini's own account of his state at this moment must be read. While writhing upon his bed the message came: "Past earthly remedy, your work is ruined." With a scream Benvenuto rushed to the furnace, more oak-wood was thrown in, and a block of tin added to the pot of metal (doubtless the furnace had cooled down, or much tin had evaporated, and the remaining metal, more rich in copper, was less fusible in consequence; it had caked and cooled); then with the forced heat the furnace burst, but the metal was partly fused though not enough, more tin was wanting; in he cast his pewter dishes, plates, and bowls, two hundred pieces of his table service; the plugs were driven in; the metal ran! The mould was filling! was full! On his knees he praised God, ate a hearty meal with his men, soundly slept away his fever, and Cellini was himself again. Notwithstanding its faults—and what human work is perfect—the Perseus is a noble statue. It stands on a base, beautifully ornamented, but somewhat small, on which is a highly poetical and picturesque bas-relief, representing the rescue of Andromeda by the destroyer of Medusa. It was set up and uncovered to the public gaze in April, 1554, the "admired of all admirers," from the duke in the palazzo Vecchio above, to the *facchino* among the crowd filling the piazza. In what a seventh heaven must the vain Cellini have felt himself to be, when thus his work was extolled and its maker flattered! He received 3,550 golden scudi for this work, which he himself had valued at 10,000, and believed to be unsurpassable.

Benvenuto's next bronze work was the grand portrait bust of his friend and patron in Rome, Bindo Altoviti, at whose palace on the Tiber's bank in the piazza, near the ponte St. Angelo, he was hospitably lodged, and where the bust still occupied its original position until the last few years. Afterwards, he made models for a small statue of Juno to be executed in bronze, which does not appear to have been cast; for shortly before his death he wrote to Francesco de Medici, to whom he bequeathed the model, stating his regret that he had been unable to complete it by reason of his serious illness, He died, at the age of seventy, on February 13th, 1571.

Francesco Primaticcio (1504-70) was engaged by Francis I. to procure casts from some of the more important antique statues which had then been recently discovered or existed at Rome, to which city he was sent in 1540.

These casts were taken by Vignola. He was also commissioned to buy antique sculpture. After his return to France, he caused the following to be cast in bronze by able French founders; the Tiber, Laocoon, Cleopatra, Ariadne, Apollo, Venus, Commodus, two Satyres and two Sphinxes. Of these fine bronzes five only now exist and adorn the gardens of the Tuileries at Paris; they are the Laocoon, Ariadne, Apollo, Venus, and Commodus; the others perished during the many troublous times of France.

The most able sculptor of this later period was Giovanni di Bologna, or perhaps more correctly Gian Boullogne, born about 1524, a native of Douai. After studying under a sculptor named Beuch, he, still very young, travelled to Rome, where he was noticed and advised by Michel Angelo. Returning homewards, he was induced to remain at Florence, under the patronage of Bernardo Vecchietta, who, himself an amateur, encouraged and assisted him in bronze casting, &c. Disappointed in the competition for the Florentine fountain, Giovanni obtained the commission for that at Bologna, and was occupied upon it, more or less, during three years; it was completed in 1556. The fountain consists of a marble base, at the lower angles of which are bronze sirens, and between them shell-ornamented basins; the second stage has armorial shields of bronze, and shells upon the lower angles; round the third, which forms a base to the bronze figure of Neptune, are four children holding dolphins of bronze, with masks between, and other ornamental details; the Neptune is nine feet in height, and the effect of the whole is very grand.

His next great work was the fine equestrian statue of Cosimo I. in the piazza, the base of which is adorned with bas-reliefs, greatly inferior to the figure above; this was finished in 1594. He also was engaged with his pupils, Pietro Tacca and Pietro Francavilla (1548-1618), on the bronze equestrian statue of Henri IV. in Paris. In a niche at Pr. San Michele is a figure of St. Luke, and on the fountain at Petraja a graceful Venus squeezing the water from her hair—bronze statues, also by Giovanni.

John, of Bologna, had many pupils and assistants working in his studio and at his furnaces, from whence came many charming statuettes and minor ornamental objects. As with the smaller works of Verrocchio, Pollainolo, Cellini, and other bronzists, we have no record of each object, yet they carry their own certificate of characteristic style, approximately indicating the hand which modelled them, or at least the studio whence they came. His last great work was the bronze gates of the cathedral at Pisa, replacing those by Bonanno, which were destroyed by the fire in 1595.

Here his own inferiority, and that of sculpture in bas-reliefs at his time, as compared with his works of the two preceding centuries, are made painfully apparent. No religious feeling is to be discovered in these confused but well-executed *relievos*, the clever casting of which is due to Domenico Portigiani, whose father had a similar share in the production of the Bologna fountain. Domenico worked also at six statues and as many bas-reliefs which Giovanni had modelled for St. Anthony's chapel in S. Marco, at Florence. In the Annunziata he had enriched the chapel of the Madonna del Soccorso with some bas-reliefs and a crucifix of bronze. There he was buried in 1608, aged nearly eighty four.

We have now arrived at that period when the arts were in rapid decline, not from technical and mechanical incapacity, nor timidity of undertaking, for scale increased as art diminished, but from an absence of higher motive, and a consequent degeneration in purity of taste, resulting in offensive mannerism.

Trade Notes.

THE *Watchmaker, Jeweller, and Silversmiths' Journal* prizes of £1 11s. 6d. and £1 1s., offered for competition to the Classes on Watch and Clockmaking at St. Thomas' Charterhouse School of Science, Session 1881-82, have been gained by Messrs. T. D. Wright and J. Bray, respectively.

THESE classes will be resumed early in October next, for the Session 1882-83.

MR. I. HERRMANN is engaged by the Young Mens' Christian Institute to conduct a Class on Watch and Clockmaking, at the Polytechnic, Regent Street, every Wednesday evening during next Session. An opening Lecture will be given by the Teacher on the first Wednesday evening in October, to which intending students for the class at either institution are invited. J. A. Lund, Esq., is expected to occupy the chair.

THE French Chamber has decided that the money realised by the sale of the French crown diamonds is to create a fund for the benefit of invalided workmen.

THE Swiss States Council has approved the resolution of the National Council to establish a patent law in Switzerland. The measure has only now to be approved by the popular vote.

A VERY interesting collection of objects illustrating the Scandinavian Industrial Arts has been sent over to the South Kensington Museum. They have been selected as characteristic of the Scandinavian style in ancient and modern times. The collection includes richly-decorated weapons and personal ornaments dating from the earliest period, as well as an instructive series of examples of later date, down to the present day. The exhibition also contains a series of silver filigree ornaments belonging to the dress of the peasants in the Scandinavian countries and Iceland, skilfully-carved coffrets, drinking cups, and other wood-work, and a rich collection of textiles and needlework.

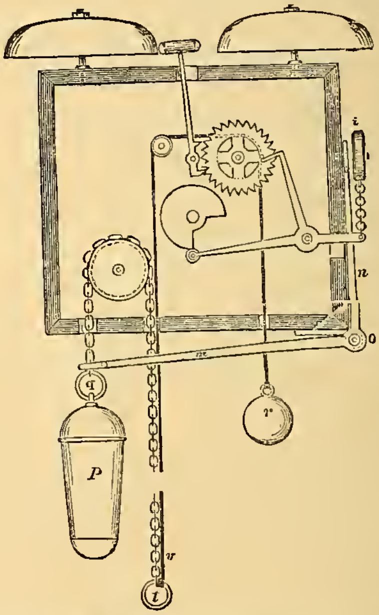
THE "Railway Guards' Watch," manufactured by the American Watch Company, which first came prominently before the trade in connection with the contracts for the Indian State railways, has proved as great a success as the other manufactures of this now world-famous concern. Some thousands of these watches have been supplied to the principal home and colonial Railways, and have given such universal satisfaction that the orders have been repeated in nearly all cases where sufficient time had elapsed to give the watches a thorough test.

MR. A. P. WHITTELL, M.D., in the *Scientific American*, says: "In making the humid assay for silver, a great deal of time is necessarily spent in waiting for the suspended chloride to settle, and leave the liquid clear, to observe the action of the next drop of the precipitant; this, even when the solution has been previously heated. I have reduced the loss of time, and insured greater facility in making an assay, by dividing the solution (containing the silver) into several, say five, equal parts in separate vessels. I place them in a row, and add, say, 3 c. c. of the solution of salt to the first, 4 c. c. to the next, 5 c. c. to the next, and so on. After the precipitate has subsided, I add, say, one half c. c. of the same solution to each of the several parts of the silver solution successively. Numbers one, two, and three will perhaps show traces of silver still in solution, but numbers four and five none. The total amount precipitated from number three, multiplied by five (as it represents only one-fifth of the original solution of silver) will be the amount of silver contained in the ore or alloy being assayed. A simple means of settling the precipitated chloride almost instantaneously, is to agitate the solution with a few drops of chloroform. Its action seems to be entirely mechanical; the agitation disperses the chloroform in minute globules throughout the silver solution, which, in settling to the bottom, carries with it every particle of the chloride.

New Foreign Patents.

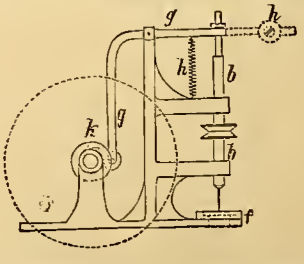
A NEW ALARM WORK, by F. Schaack, of Nippes, from the *Journal der Uhrmacher Kunst.*

A weight *i*, in the form of a ring, rests on a pin. Between this weight and the frame is the forked end of the bell-crank lever *m n*. When the weight P of the going-work is raised, the ring *i* is pushed off the pin by contact of the weight P with the lever arm *m*. The end of the chain and the alarm line are both attached to a ring *t*, so that by the act of winding of the weight P, the alarm is wound and set in gear.



MACHINE FOR DRILLING DIAMONDS AND PRECIOUS STONES, TO BE USED IN THE PLACE OF DRAWPLATES FOR WIRE-DRAWING, by H. Distel, Nurnberg.

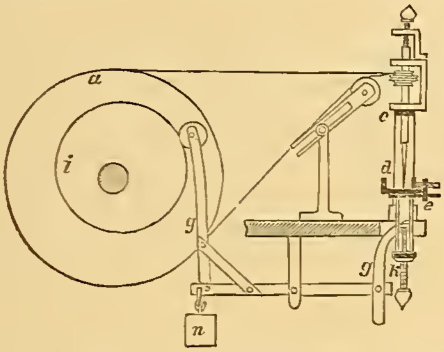
In this contrivance the contact between the drill and the substance to be drilled is alternately broken, so that the diamond powder may work its way well into the hole. This can be done either by having the drill in a stationary position,



and giving motion to the platform on which the stone rests, in a direction parallel to the axis of the drill, or inversely by having the platform fixed, and moving the drill. The latter arrangement is represented in the sketch, where *f* is the platform, and *b* the spindle of the Drill. A cam *k* gives the up motion to the bell-crank lever *g g*, and the down motion is effected either by a spring or weight *h h*.

AUTOMATIC DRILLING MACHINES FOR AGATES, by I. Liefmann, of Oberstein-ad-Notre.

The drill *c* is rotated by a string passing over the disc *a*. The stone is fastened in a clamp *e*, with parallel cheeks, and brought in contact with the drill by the adjusting screw *k*.



The clamp is attached to a bell-crank lever *g*, which is moved alternately up and down to admit oil, and prevent the drill from sticking fast. This motion is effected through the weight *n*, and eccentric disc *i*.

Where Agates Come From.

SOUTHERN BRAZIL, and especially the province of Rio Grande do Sul, with the neighbouring Uruguay, is the principal source of those stones which are sold under the name of opal, chalcedony, and agate. The trap rocks that penetrate the province in many directions, especially in the strip of high ground that branches off from Taguary, not far from the provincial capital, Porto Allegre, furnish considerable quantities of the finest agates, and in the greatest variety. They find their way mostly to Germany, and that, too, to the neighbourhood of Oberstein. These semi-precious stones, which afterwards develope great beauty, look very unattractive at first, embedded in their dark coloured clay.

Owing to the want of any railroad, and the scarcity of wagon roads, it is necessary to convey them to the river in panniers on the backs of asses, mules, and horses. Of course, before they are packed, an effort is made to ascertain, as nearly as possible, the value of these ill-favoured lumps of stone. Therefore, many persons devote zealous study to testing and recognising valuable nodules of agate; and those agate seekers who are practically, as well as theoretically, schooled in this, are richly rewarded for their trouble.

The chief point in South Brazil for the collection of these semi-precious stones, and at the same time the seat of the agate exchange, which is still in its infancy, is the little city of Rio Pardo, at the mouth of a river of the same name, where it enters the Rio Jacuhy, one of the oldest places in the province of Rio Grande do Sul. Up to 1870, the agate exchange was ruled, almost exclusively, by a Swiss firm named Luchsinger. In front of their shabby little stores, long trains returning from the inland country halt every week to pile up their rough stone treasures in and about the house. For months these heaps grew to small mountains, until their bulk and weight were sufficient for a ship's cargo, when they were shipped on the river sailing vessels, called Lanchaoes, to the port at Porto Allegre or Rio Grande.

The European destination of these rough agates, &c., is either Belgium or the home of the German agate polishers at Saar or Oberstein. The Brazilian semi-precious stones have a rival, hard to conquer, in the Indian carnelians, opals, agates, and jaspers, which come into competition with them at Oberstein, and pour in there uninterruptedly, and are, at least, as numerous as the former. Still, the demand for raw material is very considerable; and since the Franco-Prussian war there has been an increase not to be under-estimated, from the return of hundreds of German agate polishers and engravers that have been driven out of Paris.

OBERSTEIN.

According to Mayer, the Brazilian agates have been wrought at Oberstein for half-a-century, and have almost entirely crowded out the native raw material. Mortars, burnishing stones, cameos, clasps, bracelets, rosaries, cane heads, knife handles, and other trinkets, are the articles for which important quantities of agate are used up, year in and year out. The number of persons employed at Oberstein in polishing agates is estimated at about six thousand.

The working in agate has been known in that strip of land beyond the Rhine for centuries. Of more recent origin, only in the co-operation of the portrait carvers, cutters, and gold workers.

In the course of time, the Oberstein agate industry has developed from small beginnings to a branch of industry that is in communication with the whole world. Its intimate relations with Brazil probably date from the time of the first great emigration of Germans to Brazil in 1820. The persons who, according to the Cologne *Gazette*, sent over a cargo of stones in 1834, may have been lapidaries that migrated from Oberstein. Klnge puts the importation of Brazilian stones somewhat earlier, in 1827.

An agate exhibition at Idar, near Oberstein, in July, 1879, offered a striking picture of the state of this industry at that time. We are indebted, says Ausland, to this favourable opportunity and to the kindness of the well-known engraver, Mr. Charles Fuchs, of Kempfeld, near Oberstein, for the following description and statistics.

QUANTITY USED.

The agates which are brought from Brazil and worked up here annually amount to about 250 or 300 tons. The moss agates and heliotropes from India, which are used in Oberstein are estimated at 300 cwt. (15 tons). The jaspers, which are found in the region of the Saar, are mostly blue, and are known in the market as real jasper, of which there are about 500 tons. Besides all these, there are used at Oberstein about 300 to 400 cwt. of so-called real lapis-lazuli, then amethysts, labradorite, obsidian, and quartz crystals.

There is a sale of such raw material almost every week, mostly at public auction, and by weight. Under these circumstances, the prices vary extraordinarily; as, for instance, from 37.50 dollars to 500 dollars per cwt., and not unfrequently, still higher prices are paid. Stones, for example, that are found to be particularly adapted to making cameos and intaglios, have the highest value, and will bring 750 dollars cwt.

The Brazilian stones come to the Oberstein agate market in blocks weighing ten or fifteen cwt., and so on down to ten ℔., to be soon converted by the skilled hand of the polisher into every possible article of daily use or of luxury. The most ungainly, gigantic blocks are first broken up with hammers and chisels, and from the pieces which are still unwieldy and inconvenient, smaller ones are sawed out by disks set with diamonds, and finally out of these the agates are formed on large sand-stone plates. The chief articles made at present, besides those already mentioned for ornamental purposes, are those for industrial uses, such as rollers for paper, stones for clocks and watches, compasses, smooth and polishing stones, &c. In Brazil they know but one use for the round agate nodules, the natural stone bullets, and that is for bolas (stones used in throwing the lasso). At the present time the agate seeker in Brazil is, however, rarely able to collect his treasures entirely free from cost. Speculative Brazilian property holders have long been cognizant of the fact that when the agate balls are dug out of their property, a possession is taken away which might bring them a small income. For some years past they have not allowed the agate seekers unlimited access to their lands, but demand that they shall either buy or lease the land.

Commercial agates are divided into two classes: natural stones and those that are artificially coloured.

(*To be continued.*)

A List of Watches, Watch Movements, Clocks, &c.

THE PROPERTY OF THE WORSHIPFUL CLOCKMAKERS' COMPANY, AND DEPOSITED IN THE GUILDHALL, LONDON.

(*Continued from page* 156.)

106. A piece of mechanism in form of a Watch, engraved at back: "Made by B. Gray, Clockmaker to George II. Given to Charles Frodsham, by his Great-Grandson, B. L. Vulliamy, 1849." Supposed to be an idea for a pedometer, for riding purposes.
Presented by Charles Frodsham & Co., 1875.

GRAY, B., and VULLIAMY, JUST., London.
107. Gold Watch, vertical enamel dial on gold. N. N. S. Outer Case of Shagreen. Cost, in 1753, £13 15s. 7d.* to manufacture.
Presented by B. L. Vulliamy, 1853.

GRAY, JOSEPH (Shaston).
108. A very Ancient Vertical Movement, with curiously pierced pillars. An early attempt at regulation, by means of a screw and index.
Presented by C. R. Harle, 1875.

GREBANNALL, ROBERT, Rouen.
109. Silver Petagon, engraved case; subject, Jacob's Dream. Gilt dial, coat of arms inside the bottom; date about the middle of the sixteenth century. A very good specimen.
Purchased by the Company, 1863.

GREGG, FRANCIS, London.

Apprenticed to John Clowes, September 7, 1691.
110. A Bell Repeater, with silver cap. No. 6226.
Presented by B. L. Vulliamy, 1816.
111. A Repeating Movement, capped, enamel dial.
Presented by B. L. Vulliamy, 1816.

GRETTON, CHARLES, London.

Apprenticed to Lionel Wythe, June 30, 1662; made free of the Company, June 3, 1672; chosen on the Court of Assistants, July 1, 1689; served the office of Warden, 1697-9; chosen to the office of Master, September 30, 1700; and was a Benefactor to the Company.

112. A Gold Double-case Watch, with coloured gold-chased dial, jewelled, the outer case struck up in imitation of engine-turning.

113. A Silver Double-case Alarm Watch, with silver dial. The box curiously pierced and engraved; the outer case being of skin, inlaid with silver.

GRIGNION & SON, London.
114. An Eight-day Regulator, with twelve-inch silvered dial plate, beating dead seconds. The escapement is of a very peculiar and delicate construction, the pallet receiving impulse on one side only. There is also a very ingenious and simple mode of keeping the clock going during the time of winding. On inserting the key, a lever is raised, which puts into gear a spring acting directly on the centre wheel, whereby the power is maintained during the process of winding. On withdrawing the key, the spring becomes released, and returns to its former inert position.
Presented by John Grant, 1875.

HALEY, CHARLES.
115. Gilt Movement, Remontoir escapement, $^{\text{P}}_{\text{D. N.}}$ Invt. et fecit.
Presented by F. B. Adams, July, 1869.

116. Gilt Pocket Chronometer, with enamel dial pivoted detent, and peculiarly constructed compensation balance. No. $\frac{\text{C. A.}}{1513.}$ Invt. et fecit.
Presented by F. B. Adams, July, 1869.

HANDS, TIM., London.
117. Plain Vertical Movement, no dial. No. 885.
Presented by B. L. Vulliamy, 1849.

HARPER, London.
118. Plain Verge Movement, no dial. Tulip pillars.
Presented by Messrs. G. & S. E. Atkins, 1850.

HARRISSON, JOHN (see portraits).
119. Long Eight-day Clock in Wainscot Case, with transparent dial, the frames, wheels, and pinions being of solid oak, made by John Harrison, being his first production while following the trade of a carpenter at Foulby, near Pontefract, Yorkshire. One very similar is preserved at the South Kensington Museum, date about 1715.
Presented by W. Thoms, 1875.

HERBERT, CORNELIUS, "London Bridge."
The Records of the Company show that there were two of this name, one apprenticed to the other, January 19, 1690; made free, March 3, 1700; chosen one of the Court of Assistants, January 14, 1722; served the office of Warden, 1725-6; and chosen Master, September 29, 1727. The probability is that this was made by the elder Herbert, whose house stood on London Bridge.
120. A Plain Vertical Movement.
Presented by Messrs. G. & S. E. Atkins.

HERON, ISAACK, New York.
121. Vertical Movement, No. 57, enamel dial, evidently English make.
Presented by B. L. Vulliamy, 1816.

HIGGS & EVANS, London.
122. Vertical Movement, remarkable for the unique character of its pillars. No. 6314.
Presented by Edward Streeter, 1875.

HUBERT, ESTIENNE, à Rouen.
123. Old French Movement with catgut, pinion on fusee arbor, no dial or motion.
124. A Small, Imperfect, Oval Movement, with catgut, hour-wheel driven by lanthorn pinion (a fragment).
Presented by B. L. Vulliamy, June, 1816.

(*To be Continued.*)

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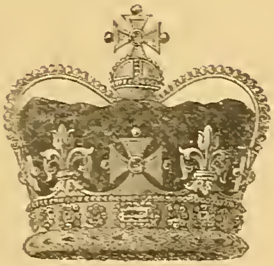
* These prices are curious, as contrasted with the cost of similar watches at the present day.

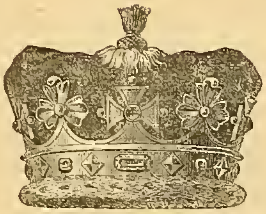
Supplement to the Watchmaker, Jeweller, and Silversmith, August 5th, 1882.

MONTHLY SUPPLEMENT OF DESIGNS.

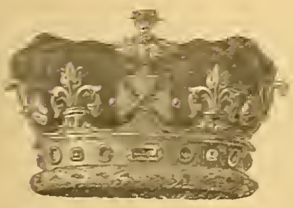
BRITISH CROWNS.



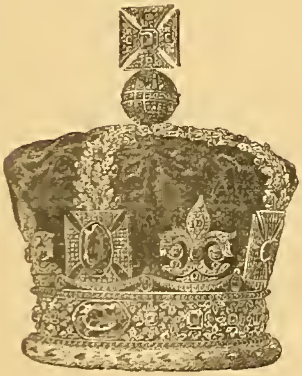
102.—Coronet of the Prince of Wales.



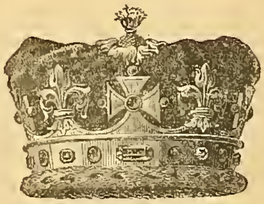
103.—Coronet of the Royal Nephews.



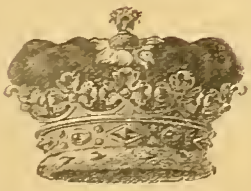
104.—Princes' Coronet.



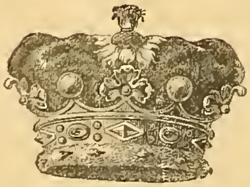
101. Royal Crown I.



105.—Princes' Coronet.



106. Ducal Coronet.



107. Coronet of a Marquis.

From "Crowns of all Nations," Published by J. Fischer, 11, Saint Bride Street, London, E.C.

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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TWO ILLUSTRATED SUPPLEMENTS :— 1. British Crowns. 2. Antique Rings and Ornaments.

No. 87.—VOL. VIII.] AUGUST 5, 1882. [Subscription, 5s. per Annum. Post Free.

Our National Watch Factory.

BY A HOROLOGICAL ZADKIEL.

(Continued from page 2.)

ON leaving the office our American friend consulted his watch (made by a well-known Clerkenwell firm) and concluded that he would occupy the remainder of the day in visiting the East and West India Company's new docks at Tilbury. Accordingly, in forty-five minutes he was gazing on the latest proofs of England's pre-eminence as a maritime nation. Among the magnificent fleet of ocean-going steamers, which were peacefully reposing in the capacious basins, he particularly noticed the "Oregon," launched in 1883, which had just returned from Calcutta, *via* the Cape, in twenty-eight days, being one-fourth of the time formerly taken by sailing vessels.*

After traversing every accessible part of the five-hundred acres belonging to the Dock Company, during which exploration he was more than once reminded of the existence of the National Watch Company, he adjourned to the Railway Hotel, where he looked through the pamphlet which was referred to last month.

Passing over the engravings and descriptions of the machinery and tools employed, as requiring more study than at the present time he felt disposed to give to them, and glancing at the Press notices, which were unanimous in their commendation of the enterprise and public spirit shewn by the promoters of the undertaking, he read with many expressions of approval the following account, reproduced from *The Citizen* of November 28th, 1885, of the inaugural dinner of the Company.

DINNERS AND FESTIVITIES.

The Watch Makers at the Crystal Palace.

On Thursday evening a truly representative gathering took place at the above favourite resort of the toiling multitudes of our ever-increasing city. The party, one hundred and fifty in number, travelled from Ludgate Hill by a special electric train, and at six o'clock precisely sat down to a *recherché* repast which was served in the well-known excellent style of the energetic contractors to the Palace. Among the guests we noticed, The Prime Warden of the Goldsmiths' Company, The Master of the Clockmakers' Company, The Master of the Turners' Company, Sir Redmond Heckett, Bart., Alderman Sir J. Dennett, Colonel Monckton, R.A., M.P.; T.A. Morrison, Esq., M.P.; and Major Datthey, L.R.B. The Council of the Horological Institute were strongly represented, as were also the various charitable institutions connected with the trade. Last, but not least, must be noticed a deputation from the City and Guilds Institute; and the Editors of the leading trade journals.

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* The rapid voyages of large steamers have seriously interfered with the demand for new chronometers.

The Chair was occupied by John Mainspring, Esq., and the Vice-chair by J. Turner Pivot, Esq.

At the conclusion of the dinner the chairman proposed the usual loyal and patriotic toasts, dwelling especially on the manner in which the several branches of the service had sustained the honour of the country during the severe conflict from which they had just emerged, and thanking Colonel Monckton for his personal services in connection with the Ambulance department. He also referred to the patriotic manner in which the Volunteers had performed garrison duty, saying that the City Regiments had shown a brilliant example to their comrades in arms, having had the responsibility of defending the forts erected between Tilbury Fort and the mouth of the Thames, which had been rendered necessary in consequence of the shipping business being removed to a more exposed part of the river during the last seven years.

Colonel Monckton suitably responded for the Army and Navy, and Major Datthey for the Reserve Forces.

The next toast submitted was The Houses of Lords and Commons, proposed by Sir Redmond Heckett, and responded to by Mr. T. A. Morrison, M.P., who, in the course of his remarks, took occasion to express his satisfaction at the course recently taken by Her Majesty's Government, in deciding to abolish the system of the compulsory Hall Marking of watch cases, as recommended seven years previously by the legal advisers to the Goldsmiths' Company. His only regret was that this result had not been brought about by a Liberal Government, but he should always regard it as a Liberal measure, and one to which he himself had largely contributed. The new Company would have all the benefits of increased liberty of action, which he thought was a great point in their favour; all he wanted now was similar liberty in a kindred trade, and it would soon be discovered that our skilled workmen could find remunerative employment at home, instead of being compelled to emigrate to America.

The Chairman then proposed the toast of the evening, viz:—"Success and Prosperity to the National Watch Manufacturing Company." He said that it was not his intention to weary his audience by the delivery of a long speech; he was a man of deeds, not words, and there were other gentlemen present who were far more qualified to speak on the subject than himself. His own interest in the Company was chiefly financial, as he had a stake of £100,000 in it, and those who knew him best were aware that he had worked for his money, and was not very likely to risk it in an insecure venture. His esteemed friend, the Vice-chairman and managing director of the Company, was thoroughly acquainted with all the practical details necessary for success, and he did not hesitate to say that he felt that the interests of the shareholders would be quite safe in that gentleman's hands. He now begged to propose the toast, which was drunk with enthusiasm. After a short interval, Mr. J. Turner Pivot rose and said that after the complimentary manner in which the chairman had alluded to him, it was, perhaps, incumbent on him to say a few words. He might say that he had been forced to take up the position he found himself occupying in connection with the National Watch Factory, by the pressure of trade criticisms and public opinion. Five years previously there was, perhaps, no one more prejudiced against the introduction of machinery and the factory system than himself, and he now found himself quite at variance with most of those practical watchmakers with whom he had hitherto been associated. It was not, however, the intention of the Company to introduce startling changes, they were not slavishly following the lines of the American or any other companies, for, placed as they were in the centre of the manufacturing district of Clerkenwell, they meant to retain the best features of the old system, and graft as much of the new on to it as was necessary to ensure cheapness and rapidity of production. He felt bound to pay an especial tribute to the business qualities of their Chairman and the remaining Directors, without whose assistance he could do very little. Before sitting down he would propose the health of the three gentlemen present who represented the City Companies, which were allied to the trade.

After the toast had been drank, the Prime Warden of the Goldsmiths' Company said it afforded his Company much pleasure to countenance any movement which appeared likely to benefit the trades which were in affinity with the Guild. He hoped the National Watch Company would flourish, as he did not like to see any trade leave the country, especially a trade of skill and science like Watch and Clock Making. Despite strikes and divergent views upon trade matters, we could still work cheaply and well in this country, and he could not see why watches and clocks should not be made as cheaply and well in this country as in any other. Whatever an Englishman applied his hand to, if he chose to do it he would do it well. The Goldsmiths' Company had always been on very good terms with the Clock and Watchmakers of Clerkenwell, and he trusted their friendly relations would long continue.

The Master of the Clockmakers' Company said he remembered the time when the clock trade was lost to the parish of Clerkenwell, because the artisans did not take sufficient pains to compete with the French market; and unless the new undertaking proved a success, he feared that the watch trade would be similarly lost to us. Self-interest would solve the problem as to how we could retain the trade. If the Americans possessed machinery, we possessed machinery also, and ought to be able to compete with them. It behoved us to compete with the Foreigner, and he thought British pluck was equal to the emergency. He was glad to see that an organised attempt was being made to prevent our products from being beaten out of the market, and hoped it would succeed. He did not altogether agree with free trade, but the time had passed for Protection, and we must endeavour to compete with the times as we found them; shewing the foreigners we could manufacture as well as they were able to manufacture.

The Master of the Turners' Company also followed in the same strain.*

The Chairman then proposed the health of their genial old friend, Alderman Sir J. Dennett, without whom no gathering of Watchmakers seemed complete. He had not been left to the last through any disrespect, but they wished to get through the more serious business of the evening, in order that they might fully enjoy the treat which they all felt was coming.

Alderman Sir J. Dennett, who was received with enthusiastic applause, said, that unaccustomed as he was to public speaking, he would do his best to fulfil the expectations called forth by the chairman's remarks. The present gathering only furnished an additional proof of the truth of the old proverb, that everything would come round if you only lived long enough. He understood that numbers of young women were to be employed by the Company. Well—thirty-five years previously, he had advocated this, and had only been laughed at for his pains; indeed, more than once he had to make a precipitate retreat from audiences who were of a different way of thinking. It mattered not much to him, he would have been glad to have employed English labour had the sapient Clerkenwellers allowed him; but he got much of what he wanted in Switzerland. When, however, the watchmakers here found that watch factories were firmly established in America, and that the "Yankee Gals" were trying their hands at it, with pretty good success, too, they began to think that there was something in his ideas after all. With regard to this Factory, he did not feel called upon to say much at present; but he gave them all fair notice that he was not afraid of it, and whatever they did, he always meant to do something better. Still, it was a plucky venture, and he appreciated pluck in anyone; the world was wide enough for all of them, and all he hoped was that the best men might win, and that the directors would be in as good spirits at their next dinner. Rome was not built in a day, and he could assure them that they had some up-hill work before them. His own motto had always been, "Never say die;" and he knew that they had men among them who were able to act up to it. He had made *his* way, and by the same rule they might make theirs.

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* See the speeches of the representatives of the City Companies, at the opening of the new building of the Horological Institute, as reported in the *Journal* for December 1879.

The remaining toasts were, "The Educational and Charitable Institutions connected with the Trade;" "The Press and Trade Literature;" "The Chairman," and "The Ladies."

During the evening selections of vocal music, including "My Grandfather's Clock," "The Watch on the Rhine," "Father, come Home," and other appropriate melodies, were given by talented artistes.

"Well!" said the reader of the foregoing report, "there is no doubt about these Britishers being able to *talk;* to-morrow, I guess I want to see some of their *work.*"

(To be Continued.)

Index to Antique Rings and Ornaments.

53, 54—Episcopal ring found in the Cathedral of Hereford during the repairs in the choir, in 1843. It belonged to Bishop Stanbery, who held the see from 1452 until his death in 1474. The ring is of gold, set with a sapphire, and the sides of the ring are decorated with sprays and flowers.

55—Episcopal ring in the possession of W. Huxtable, F.S.A. It is of bronze thickly gilt, and set with crystal.

56—Fibula, found at Driffield, Yorkshire, in the grave of a female. It is of bronze.

57—Episcopal ring in the Londesborough collection.

58, 59—Bronze brooches worn by the humbler classes. They were found by labourers employed in repairing the road about a mile from the Roman British settlement, at Cesterover, between Bensford Bridge and the road leading from Rugby to Lutterworth.

IMPORTANT NOTICE.

WANTED, a TEACHER for the Silversmiths' Technical Class, established by the Young Mens' Christian Institute, and to be held at the Polytechnic, Regent Street. For all particulars, apply to Robert Mitchell, Esq., *Sec.*, Young Mens' Christian Institute, 48 & 49, Long Acre, London, W.C.

Standard Time for the World.

AT one of the sessions of the American Society of Civil Engineers in Washington, May 17th, 1882, a report on standard time was presented by Mr. Sanford Fleming, chairman of a committee appointed to investigate the subject at a meeting of the society, in Montreal, last year.

In response to the request of the society, at its meeting in January, the committee has submitted to a large number of persons directly interested in the matter the following scheme for the establishment of a prime meridian, and a uniform standard of time, with a series of questions to which replies were requested. To these questions some hundreds of replies were returned, ninety-seven per cent. of the writers approving of the scheme, and ninety-two per cent. favouring a number of the hours from one to twenty-four consecutively.

The scheme under discussion proposes:—

First—To establish one universal standard time, common to all people throughout the world, for the use of railways, telegraphs, and steamboats; for the purposes of trade and commerce, for general scientific observations, and for every ordinary local purpose.

Second—It is proposed that standard time everywhere shall be based on the one unit measure of time denoted by the diurnal revolution of the earth, as determined by the mean solar passage at one particular meridian to be selected as a time zero.

Third—The time zero to coincide with the initial or prime meridian to be common to all nations for computing terrestrial longitude.

Fourth—The time zero and prime meridian of the world to be established with the concurrence of civilised nations generally.

Fifth—For the purpose of regulating time everywhere, it is proposed that the unit measure, determined as above, shall be divided into twenty-four equal parts, and that these parts shall be defined by standard time meridians established around the globe, 15° of longitude, or one hour distant from each other.

Sixth—It is proposed that standard time shall be determined and disseminated under govermental authority; that time signal stations be established at important centres for the purpose of disseminating correct time with precision, and that all the railway and local public clocks be controlled electrically from the public time station, or otherwise kept in perfect agreement.

Seventh—The adoption of the system in the United States and Canada would, exclusive of Newfoundland and Alaska, have the effect of reducing the standards of time to four. These four standards, precisely one hour apart, would govern the time of the whole country; each would have the simplest possible relation to the other, and all would have equally simple relations to the other standards of the world.

Finally—It is proposed to have only one series of hours in the day, extending from midnight to midnight, and numbering from one to twenty-four without interruption; to number the hours between midnight and noon (one to twelve) precisely as at present, and to denote the hours between noon and midnight by letters of the alphabet.

The society adopted resolutions requesting Congress to take the initiative step towards establishing a time system on the basis of this scheme, by endeavouring to establish a prime meridian which shall be common to all nations.

The Worthies of Horology.

By C. Stuart Murray.

IV.

WHEN I was at Dover in the year 1871, like most other wanderers I betook myself to sight-seeing. An ancient craftsman of wheel and pinion-work implored me not to miss inspecting a "rare old clock" in the Castle. To the famous fortress I accordingly hastened, and, "armed" with pass and countersign, was soon threading my anxious way up the steps that led to the "Donjon keep." I did not begin to make special inquiries all at once, but my guide ushered me into a large hall, a kind of military court or apartment for the assemblage of the governing authorities of the fortress. The walls had just undergone a somewhat extensive course of "limewash and paint," and a number of men were busy with a liberal supply of soapsuds, mops, and brushes. As I was doing my stepping-stone tiptoe among the streams of suds, what should I stumble upon in a half-tide pool of the mixture, leaning against a wall by a corner of the floor, but the "rare old clock!" Reader, I gasped with the choking of indignation, and uttered such "fearful" threats as to what I should say to the War Department when I "returned to town," that some "superior person" was quickly on the scene. The clock was lifted out of its sud-seething bed, carefully wiped amid a severe reprimand to the men of mops and brooms, and placed where I could examine it to my heart's content. What they took me for at the moment I cannot say, for I was not at all communicative about myself, but when I got home I wrote a letter to the proper officer in Pall-Mall, the substance of which was not long in reaching Dover Castle, and, as I afterwards learned, made "a deuce of a row all round." I was told that the correspondence upon the subject led to the removal of the antiquated cause of it all to South Kensington, where it may now be seen. Without vouching for more of this incident than what passed within my own knowledge, the question naturally arose at the time—"Who made that clock?" I asked my guide, who seemed to be deeply learned about everything connected with the "old world" part of the castle, and he, after a few undertones with some of his colleagues, "thought that that clock must have been made some hundreds—aye, *hundreds of years before the Norman Conquest!!!*" That was too much for me; I became suddenly "hot i' the mouth," and was led in an enfeebled state to the castle canteen. There, on my being tenderly seated by my guide, the "flop" of the cork of a "bottle of bitter" just saved me from fainting—by the skin of my tongue, as it were.

That my anger was not all sentimental will, I think, be admitted upon reading the following.

The late Admiral Smyth, in 1850, communicated to the Society of Antiquaries, of which he was a director, the subjoined particulars of the Dover Castle clock, but without being able to say who the horological "Worthy" was who made it. Speaking of De Wyck's large clock of 1364, he goes on thus:—"But, since the printing of that paper, I have examined one still older than De Wyck's, which weakens the claim set up for Megestein, of Cologne, as the original proposer. I mentioned that Mr. Rowel, of Oxford, told me he had seen the remains of a very early clock in a tower of Dover Castle; and the Board of Ordnance having kindly ordered it to be placed under my examination, I repaired thither, accompanied by Mr. Vulliamy, and every attention was paid to our wishes by Mr. Gange, the Ordnance Storekeeper, in whose charge it is kept. We were delighted to find, nearly entire, an unsophisticated old clock, bearing the date 1348; the wheels, fly-vanes, and frame being of wrought-iron, and it was wound up by means of small spokes on the end verge of a cylindrical wood barrel. Deeming this relic worthy of the utmost preservation, I requested Mr. Gauge to remove it from the tower stairs, where it had long lain, into the armoury of the castle, and there place it on a pedestal in a spot which I was allowed to select for that purpose. That gentleman showed much zeal for its future safety, and, after washing and carefully brushing the dust off, he had a thin coating of boiled linseed oil laid on; so that it may now be preserved for many ages. Mr. Vulliamy took the necessary measurements for a professional description of this remarkable relic, with a view to its being published. I shall therefore now only trouble your Lordship with the annexed sketch of the balance and escapement, as a specimen which is sixteen years older than that which I gave of De Wyck's." And this is the "remarkable relic" that I saw in the soapsuds when I was at Dover Castle! No wonder that there should have been "a deuce of a row all round," when its degraded position became known to the superior authorities. Although I am not upon clockmaking, I may just state that the escapement of this first among the clocks is the well-known verge, the balance being a bar weighted. The weights are nearly egg-shaped, and are tapped lengthwise with a hollow screw, which screw threads on a solid one at the end of each bar. It is by these screws that the clock is regulated.

Who was the father of this clock, the horological "Worthy" here? Most of us fall back upon De Wyck; but De Wyck, according to what we have before us, seems to be a lower step in the ladder of discovery. We are now in the fourteenth century, and a good deal of haze must be expected to surround the inquirer into mechanical inventions of that period.

We find ourselves in the ancient, pleasant country town of Wallingford, on the banks of the Thames, of which the celebrated Sir William Blackstone, of the "Commentaries of the Laws of England," was once Recorder. Wallingford is a very ancient borough, having flourished with its castle and its priory for hundreds of years. It has had the honour of being beseiged and taken by the Danes, as far back as 1006. It was a fitting place for the production of a horological "Worthy," or, if not the production, at least the patronage of one. Although only about fifty miles from London, it was a very stirring place in the times of old. "William the Conqueror," as the Britons "who never will be slaves" persistently delight to dub him, went there after the battle of Hastings, to receive the homage of the principal nobles of the kingdom, before marching to London. King Stephen, the "worthy peer" of the old song, whose "unmentionables" only cost him half-a-crown, laid siege to the town several times without success; the Empress Mand found shelter there; Richard the First was imprisoned in its Castle; King John met his bold barons there; it went through further seiges, and ultimately stood out for Charles the First during the Civil War until it had to surrender to General Fairfax of the Parliamentary Army.

In the early course of these stirring events we find a Richard de Wallingford, of whose machine mention is made, that in the fourteenth century it was considered as the oldest clock known. I will give Hamberger's text of Lcland, in reference to Wallingford:—

"Being chosen superior of the monastery, as he was now enabled by his ample fortune, he resolved to show by means of some glorious work a miracle not only of genius, but also of excelling knowledge. He therefore, with great labour, with greater expense, and with the utmost art, constructed such a clock as, in my opinion, exists nowhere else in Europe; whether we observe the course of the sun and moon, or the fixed stars; again, whether we consider the ebb and flow of the tide, or the lines together with the figures and demonstrations various almost to infinity: and when he had brought to perfection this work so worthy of eternity, he drew up rules for it, as he was the first man of his age in mathematical learning, which he published in his book, lest so excellent a machine should fall into disrepute through the mistakes of the monks, or should become silent from the law of its structure being unknown." The name of this "machine" was a kind of play upon words, being called Albion—(All by one). From what the reader has now learnt, I think that he need be in no doubt about accepting Richard de Wallingford as a very shining Worthy of Horology indeed. He was abbot of St. Alban's.

I now come to a disputed point about where the first public clock was put up. One authority states that it was at Bologna, in the year 1356; whilst Peter Paul Vergerius gives evidence of a strong character in quite a contrary direction. No instance of a clock being in action is put up anywhere previous to that of Wallingford. Vergerius tells us that Hubert, prince of Carrara, ordered the first public clock to be put up at Padua. "He caused to be built at the top of the tower a clock in which, during day and night, the four-and-twenty hours pointed themselves out." I further learn that the "Worthy" who made the said clock was one James Dondi, and that the Dondi family afterwards had the name of *Horologio* bestowed upon them in consequence. There was a title, if you like! Upon his tombstone, too, were verses to commemorate that circumstance.

This Dondi left a son, John Dondi, who, contrary to the usual arrangement of Nature in such cases, became a greater clockmaker than the father. The son made a clock which has thus been described:—

"In which was the firmament and all the planetary globes, so that the movements of all the stars were comprised as in the heavens; it shows the days appointed for festivals and many other things wonderful to be seen. So great was the admirable construction of this clock, that after his death no one knew how to correct it, nor to assign the suitable weights. At length, a skilful artist from France, attracted by the fame of this clock, came to Pavia, and employed many days in arranging the wheels, which he succeeded in putting together in proper order, and gave it the right motion."

Now, here—the Dondi family—are two Worthies of Horology of whom, probably, not one clockmaker, or more than one clockmaker in a hundred, has ever heard of before.

Further investigation has enabled me to throw some light upon the dispute as to whether Bologna, or Padua, had the first public clock. It appears that in the year 1356—"On the 8th day of April, the great bell of the tower which was in the palace called della Biada, belonging to Giovanni, lord of Bologna, was removed, and was conveyed into the Corte del Capitano, and was drawn up and placed on the tower del Capitano on Holy Wednesday; and this was the first clock which the State of Bologna ever possessed, and it began to strike on the 13th May, which Messer Giovanni caused it to do." This quotation settles the dispute so far, that the above was the first public clock that was set up in Bologna; but not the first of *all* public clocks, for it has been shown clearly that there was one, if not two, before it in other places.

We now come to Henri de Wyck, or Henri de Vic, as the name has been spelt. He is looked upon by many clockmakers as the most ancient of all horological worthies, but the first specimen of his handicraft is sixteen years later than even that of the Dover Castle Clock. As this artist's name has been only mentioned in a bare way in connection with his work, I think that the following passage from Professor Hamberger may be usefully quoted here:—

"Some time after the year 1364, Charles V., surnamed the Wise, king of France, caused a large clock to be placed in tower of his palace, by Henry de Wyck, whom he invited from Germany, because there was then at Paris no artist of that kind, and to whom he allowed a salary of six sols per day, with free lodging in the tower."

In my searches after information for this paper, I have found a beautiful poem by the historian Froissart. It is one of his earliest productions, and is called the *Horloge Amoureuse*. He gives a description of the works of the *Horloge*, not forgetting the duty of the "clocksmith." Most persons have, in the course of their reading, met with extracts from "Froissart's Chronicles," if not the "Chronicles" themselves. The author, although known as an elegant historian, never had the reputation, except among scholars of the far back reaching race, of being a great admirer of the clockwork of his time. He lived between the years 1337 and 1400, and his description of a clock and its action shows that he must have been well acquainted with everything appertaining to it in his day. Here is the opening of his beautiful poem, which I may venture to say that my readers will delight in quite as much as I have done, myself.

The clock is, if considered truly,
An instrument very fair and very notable,
And it is also agreeable and profitable;
For night and day it teaches us the hours
By the subtilty which it comprises,
In the absence even of the sun:
On which account we should the more prize its construction,
Which the other instruments do not do,
However they may be made by art and compass;
Therefore I hold him for valiant and wise,
Who first found the use of it;
When, by his sense, he began and made
A thing so noble and of such great profit.

There is a verse that is far too interesting to the clockmakers of the present day to be passed over.

Having spoken of the sun going round the earth in a natural day, comparing the clock dial and its twenty-four hours with it, the twenty-four pins answering to the twenty-four hours, and showing them very clearly, he proceeds:—

Next we must say what thing is lodged
In the third part of the clock;
It is the last movement which regulates
The striking, so that it may strike.
Now you must know how this is done:
By two wheels this work is perfected;
This first wheel carries with it
A counterpoise, by which it turns,
And which makes it move, as I understand it,
When the spring is brought up to the proper point.
And the second is the singing-wheel;
This has an object very manifest,
That of touching the little bells,
Whereby night and day, the hours above-mentioned
Are rung, be it summer or winter,
As is proper by different songs.

Leaving Froissart for a short time, I find myself in Wales about the year 1340, and feel considerably surprised that clocks were no novelties in the Principality. Our Welsh brethren are always justly sensitive in the appreciation by their country of the arts and sciences; but nobody would expect to read of their having clocks among them before the middle of the fourteenth century. Yet here we have the historie Dafydd ap Gwilym, the celebrated Ovid of Wales, thus abusing a clock for disturbing him during a delicious dream:—

"Confusion to the black-faced clock by the side of the bank, that awoke me! May its head, its tongue, its pair of ropes, and its wheel moulder; likewise its weights of dullard balls, its orifices, its hammer, its ducks quacking as if anticipating day, and its ever-restless works! This turbulent clock clacks ridiculous sounds, like to a drunken cobbler—a cobbler, too, in appearance cunning and false blindgut! the yelping of a dog in a pan echoed! the ceaseless clatter of a cloister!—a gloomy mill grinding away the night!"

And here is a singular coincidence. Whilst David of the William was denouncing the clock in the musical language of the bards, there was the courtly Froissart chanting his *Horloge Amoureuse;* the one by the rippling stream of a loved Cymbrian mountain, and the other in some luxuriant valley of sun-lit France.

Reader, what do you think of the above description of the clockwork of the middle ages? The spring, the "singing-wheels" and the "little bells" of Froissart—and that was only one verse, and the "ducks quacking" and "drunken cobbler"—alas, poor cobbler!—of the enraged Welshman?

Och! i'r cloc y n ochr y clawdd
Du ei ffriw, a'm deffroawdd!

exclaimed in anger the Ancient Briton, whilst—

L'orloge est, au vray considérer,
Un instrument très bel et très notable
Et s'est aussy plaisant et pourfitable;
Car nuict et iour, les heures nous aprent."

gently sings the Gallic muse.

Trade Recipes.

Sweaty Hands.—Immerse your hands in freshly drawn well or spring water, and leave them therein until chilled; the evil of perspiring hands may thus be removed in about two weeks. The gentleman who recommends above treatment says that he has handled polished steel on the hottest summer day since, without even leaving the imprint of his fingers thereon.

To Detect Silver in Copper.—Mr. Stolba uses the following method for ascertaining if copper contains any silver: The copper is dissolved in nitric acid, free from chlorine. To the clear solution, some drops of chloride of barium are added, and, after agitating, a drop of sulphuric acid. The silver chloride which precipitates in small quantity is carried to the bottom by the precipitated sulphate of barium, and takes, when exposed to the light, a violet colour. If this method is not found sufficient, the precipitate obtained is heated, and washed with cyanide of potassium, filtered and decomposed by means of a weak galvanic current, which separates the silver in the metallic state.

Ornamentation of Iron and Steel.—Mr. Bower has recently made a curious discovery, which promises to be of value in decorative art, as it will still further enable iron to be used in substitution for the more expensive metals. He has found that by brushing the surfaces of iron objects treated by his process with a metallic wire brush, some of the metal of which the wire is made becomes permanently deposited on the surface, producing very beautiful effects. All of the more prominent parts have the greatest deposit, which tones off to the colour of the magnetic oxide. In this way gold, silver, nickel, copper, brass, bronze, and other metallic alloys, may be deposited on the iron or steel by mere attrition. By slightly heating the article after treatment the metal appears to become permanently fixed. The results are produced by a purely mechanical operation, and are due to the fact that the magnetic oxide not being a metal and presenting a somewhat porous surface, the metal of which the wire is composed is taken off by friction, and the pores filled up. When this has been done no other metal can be deposited upon it by the same means, nor will the brushes have any effect upon the surfaces of iron or steel articles which have not been treated by the oxidising process. We thus have a new departure in the ornamentation of iron and steel surfaces, which, with the combined processes for the protection of those metals from oxidation, has a wide field before it in view of its application to constructive and decorative purposes.

Filtering.

By H. Bush.

As filterings of solutions, acids, &c., are frequently resorted to in the workshop of the jeweller and gilder, the following hints will prove of advantage in doing the work cleanly and without loss of time and substances.

Filtration is employed for separating solids from fluids, particularly when the former do not subside, or at least very slowly. To filter substances, white paper freed from size, alum, &c. (filtering paper) is folded in a conical form, called a filter, and placed in a glass funnel. The substance to be filtered is then poured upon the filter gradually. That part of the fluid which passes first, is seldom clear; it must therefore be poured back again upon the filter, until by the swelling of the fibres of the paper, the fluid acquires complete transparency. It is of advantage in filtration to introduce glass rods, bleached pack thread, or straw between the filter and the funnel, to prevent the paper from adhering too closely to the latter. Acids, alkalies, and other corrosive fluids, are best filtered by means of a glass funnel filled with pounded glass, a few large pieces being first put in the neck of the funnel, smaller ones over these, and the finer powder placed over all. The porosity of this kind of filter retains much of the fluid, but it may be recovered by gently pouring on it as much water; the fluid will then be displaced and pass through, and the water be retained in its place.

Decantation differs from filtration merely in a degree; it is the expedient by which such fluids are separated from solids, as differ considerably in specific gravity. The heavier body falling to the bottom speedily, so as to allow the supernatant fluid to be decanted, either wholly or in part, without disturbing the heavier part. Decantation is best performed from tall cylindrical glass vessels, furnished with a spout or lip.

Larger quantities of substances requiring a long time for filtration may be treated in the following manner. Provide a glass or stoneware jar, with a narrow neck, large enough to contain the entire solution to be filtered. Pour the solution into a bottle. Prepare a board cover for the jar with a conical hole in the centre of it, in which fit well a large funnel containing the filter; nail firmly two brackets, one on each side of the jar on the board cover, so as to place the cover about an inch above the mouth of the jar; the brackets to reach to the bottom of the jar and extend about six inches above the board cover, and fit a board across on the top of the brackets; in the centre of this top-board, directly over the hole of lower cover, intended to hold the funnel, make a hole large enough to allow the neck of the bottle containing the solution to pass through it, and afford a good rest for the bilge of the bottle.

Look well that the funnel is firm, and the bottle well fitted, and see that it rests firmly in the aperture of the board. Remove, then, the cork from the bottle containing the solution to be filtered, and turn the bottle upside down over the funnel, adjusting it firmly over the aperture of the board resting on the brackets. Arrange things so that the mouth of the bottle will extend one inch below the surface level of the funnel. The solution will gurgle out of the bottle until it rises to its mouth, and then stop until the mouth is again uncovered; in other words, the funnel will remain filled to the mouth of the bottle until the solution is all out.

One would suppose that the great weight of the solution would force it out of the bottle, and overflow the funnel; that is impossible, for as soon as the solution in the funnel rises above the mouth of the bottle, it totally excludes air, and cannot discharge a single drop while in that state.

Those having large quantities of solutions to filter will gain much by adopting this method, as it is, so to say, self-acting, by dispensing with refilling the funnel, after the solution contained therein is filtered.

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 10.)

> "The perfecting of the set-hand mechanism should be the subject to which special attention is directed by intelligent inventors."—Claudius Saunier.

Keyless Work.

We will continue the enquiry respecting the mechanism for setting hands in keyless watches.

2nd.—The arrangement which requires the bezel of an open face and the cover of a hunting case to be opened, in order to set the hands, is objectionable; not so much because of liability to accidental setting or being accidentally left in gear, though the hunter is by no means free from these defects; but it is objectionable in an open face. First, because it is necessary to expose the hands in order to set them to time. This is a violation of one of the first principles of keyless work, which stipulates for the protection of the entire watch, by reason of no exposure, and, therefore, no interference of the wearer with those parts which are liable to derangement on account of their great delicacy. The bezel of a keyless watch, open face or hunter, should be made without a joint, and snapped on as tight as possible—in fact, *water proof*, which not only prevents the admission of dust, but also those atmospheric influences which tend to absorb and to destroy the oil.

Here may I record my conviction that one of the chief causes of failure in our full-plate key watches, is the setting of the hands by the square of the cannon pinion. In this operation the wearer, especially if he is unskilled, is liable to derange the hands and destroy the dial. Notice the gold and silver dials of our full-plate watches, and see how their beauty is marred by accidental slipping of the key. Such bad results are impossible in a three-quarter-plate watch, and it is unwise to revive, even the semblance, this error in keyless work. The tenacity with which English watch manufacturers cling to full-plate work, is one of the most palpable proofs of our short-sightedness, and shows that we are governed more by the tyranny of custom than an intelligent apprehension of the wants of the people.

I will not enlarge further on the defects of the set hands mechanism—their name is legion,—but will venture some *hints to inventors* who are endeavouring to perfect it.

1st.—It should be borne in mind that the setting of the hands, especially in a good watch, is a matter of rare occurrence, and those who are uninitiated in operations of this kind have little chance of acquiring skill; it must, therefore, be simple and easily understood, even by those who are most obtuse in mechanical operations.

2nd.—The combination by which the intermediate keyless wheel is made to enter the minute wheel must be the reverse of automatic, when out of action it must be locked or guarded against entering the minute wheel.

3rd.—When the hands have been set to time the keyless wheels must leave the motion wheels without requiring any act or after-thought on the part of the wearer; it must be self-acting. Let it be remembered that anything that can be legitimately accomplished by automatic machinery is not only done quicker, and therefore cheaper, but it is done better than by the slow process of hand work—the liability to err being greatly diminished.

4th.—It must be simple and inexpensive; the case must not be perforated.

An inventor will find it advantageous to study all the set hand mechanisms that have been made—and I suppose there are hundreds—and then concentrate his thoughts on the subject with a single view to improvement. When Sir Isaac Newton was asked how it was he was enabled to establish the theory of universal gravitation, he replied, "I was always thinking about it,"—and all great discoveries are the result of much thought.

Let no poor man trouble himself with inventions until he sees a prospect of remuneration for his inventive labour. The patent laws in this country, by reason of their great cost, preclude the possibility of a poor man participating in the profits of an invention. Our laws are made *by* the rich, and, in this instance, they are evidently made *for* the rich. Any poor man possessed of an inventive faculty should not remain in England, he should go to America, where he will find her laws, and better still, the sympathy of her people, foster and remunerate such labour. If in *benighted* Africa, to-day, one of her sun-burnt sons should in his own field dig up a great diamond, and a word to that effect is wired to London or Paris, to New York or Amsterdam, he is immediately on the high road to fame and fortune; but if in *enlightened* England, to-day, one of her hard-working sons of toil should, from the inexhaustible mine of science, dig up some new truth that shall be fraught with infinitely greater advantage to the world than all the gems of Golconda, he is immediately robbed of his treasure, and then by common consent derided as a fool, and all this for no greater crime than that of being a poor man. Such enormities cry aloud for immediate redress.

I hold down my head in very shame when I quote a recent writer on keyless work, who says, page 54, Vol. VII.:—

"The effect of a patent is to confine a workman to one method, and prevent improvements being made by others; besides this, the demand for best watches is so limited, and the sale so slow, that by the time an inventor can make up his mind if the idea is worth patenting, *the secret has become known to others.*" Why should not the law come within the reach of all to protect a valuable invention, even as it does personal property?

I will not prefer the serious charge of dishonesty, but freely confess that anything more narrow-minded or contemptibly mean I do not recollect to have read.

To return to my subject. The bearing for the bevel-wheel or pinion in the pendant is one of the weakest and most unsatisfactory parts of our keyless mechanism. In England, we contend most strenuously for two bearings to the barrel arbor, yet it may be clearly shown that a suspended arbor that economises valuable space is more than a sufficient support. But when we make the pendant depth, which suffers most from lateral pressure, we are content with a single bearing. Any intelligent mechanic who will examine this part of the keyless mechanism in best English watches will laugh at our want of engineering skill. American watchmakers who follow our ideas most closely sacrifice the whole of the valuable bearing, for the bevel wheel in the pendant, at the shrine of interchangeability. It needs no prophet to point to the future of this construction; for a wheel having great pressure without adequate bearings must fail. The Swiss or Rod mechanism, though complicated, is as regards the pendant wheel bearing, more perfect than any in the market. The saddle or bridge lock spring is expensive, and as it forms an impassable barrier to an auxiliary bearing to the bevel wheel, this also must be improved.

Richard Whittaker.

(*To be continued.*)

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Queries and Replies.

Can any reader oblige by informing me how to put a nice dead-white appearance on silver articles after soldering them?—E. W.

Where Agates Come From.

(Concluded from page 14.)

COLOURING AND DYEING AGATES.

Red agates are often made in Oberstein by soaking them for a fortnight in nitric acid containing iron, and after drying them two weeks they are baked. The black colours are produced by warming them for fourteen days in a sweet liquid that contains honey, and then boiling them several days in oil of vitriol. Bright blue colours are obtained by the use of a bath of perchloride of iron, followed by yellow prussiate of potash. These are by no means all the colours that are produced artificially. A favourite shade of green is obtained by the use of nickel salts, followed by a soda bath. Yellows are obtained by crude muriatic acid or bichromate of potash. Favourite shades can be obtained by the use of chemicals, if the stone is sufficiently absorptive. To determine this point, an empyrical test is in general use at Oberstein and Saar. The buyer knocks off a thin sliver from the part of the nodule that seems likely to be useful, and moistens it with the tongue, noticing whether the moisture dries slowly or rapidly, and in streaks. If the absorption takes place in varied streaks, the stone is suitable for dyeing, and particularly for onyx colours. (In 1879, Cullman and Lorenz took out a patent in Germany for converting agate into onyx). This test is not always sufficiently decisive to decide the value of the stone, so that agate dealers prefer to make a real test by actually colouring a piece of the stone.

The method of colouring agates, by the use of honey, was at first a secret that belonged to a few agate merchants at Saar. Formerly, lapidaries from Rome (Romances, as the lapidaries of Oberstein and Saar called them) used to visit this region and buy up all onyx-like stones. From them these few agate merchants had obtained the secret, either by trick or bribery. It is difficult to determine whether these Romans were led to it by Pliny, which is scarcely probable, since he only half describes it, or whether the art was not rather transmitted by tradition from Italy. Agates, or onyx, streaked with white, which are frequently met with among the Brazilian stones, are by far the most in demand.

POLISHING AGATES.

In conclusion, we may give some account of how the Brazilian stones are wrought at Birkenfeld, in Oberstein. There are now about two hundred polishing mills, where they had, in 1774, only twenty-six.

THE MILLS.

In each mill there are four or five polishing stones, as large as a big millstone; they are, however, vertical instead of horizontal, and all attached to the same axle, on which there is also an overshot water-wheel. The millstones are of strong and firm quartzose sandstone, from near Zweibrucken. Two men can work side by side on one stone, and this is almost always done.

TRIMMING.

Many agates are first trimmed to nearly the desired shape with a hammer, in the use of which the workmen become very skilful, so as not to lose too much material. It depends upon the knowledge of the natural structure of the mineral and the use of the cleavage directions. When the stone is valuable, and large flat surfaces are to be polished, they are often sawed off with a smooth saw, emery and water being used.

POLISHING.

While polishing, the workman lies almost horizontal, with the front part of his body resting in a long, hollowed-out wooden bench, and presses the stone with his fingers, or a wooden holder, against the very rapidly ıevolving stone, which is kept wet by a trough of water. Ordinarily, one side of the polishing surface is provided with grooves corresponding to all the round, curved, or angular shapes which are to be given to the polished stones. The polisher can move his bench any way he pleases, just as a boy does his sled, by pushing with his foot against blocks of wood driven into the ground. In this way he is able to press the agate very forcibly against the polishing stone. This rather inconvenient position of the polisher, on his breast and belly, is absolutely necessary; for in no other way would he be able to closely watch the position of the stone on the polisher from above.

One might think, remarks Kluge, from whose work on "Precious Stones" the last few statements are taken, that this position would induce breast troubles in the workers; but he has been assured that this is not the case. The violent pushing with the sole of the foot readily elevates the breast, and raises it up from the front part of the bench. The polishers are mostly strong, healthy men. Of course they cannot work very long in that position, so that the workman has to rise up from time to time and assume an upright position, although it involves a loss of time.

The skill of the polishers is very great, and, in fact, it is astonishing how, by skilful turning between the fingers, a perfectly round marble is formed, such as boys play with. (The same marbles are made in a far more simple manner from the Untersberg marble, in the mills at Saltzburg.

PHOSPHORESCENCE.

It is not surprising that there should be a continuous stream of sparks formed by the friction of pieces of agate against the hard grindstones; but the cause of the small agates glowing all through with a pinkish-white light, even in the day time, cannot be identical with that which causes the stream of sparks, but must be looked upon as a real phosphorescence, produced by the jarring of the molecules.

The grindstones have to be frequently roughened on the surface (sharpened), so they will take hold better on the agates.

DANGERS.

It frequently happened, formerly, that the great velocity would generate such a strong centrifugal force as to tear the stones in pieces, which would not only kill the workmen, but destroy the whole works up to the roof. Great care has to be observed in selecting the grindstones, and those having any flaws cannot be used. In recent times, accidents of this sort are not common, owing to the great care taken in selecting the stones.

DEPRESSIONS,

Like those in dishes, vases, caskets, boxes, plates, &c., are made by small rotating stones, corresponding in size to the cavity to be excavated. For boring holes, the tool is armed with diamond points, or steel borers are used with diamond dust on them. Finally, the polishing is done on vertical or horizontal discs of lead or tin, covered with ferriferous earth and water. Almost all the machines are geared to the main axle on which are the large grindstones, so that water-power is used for all of them.

It might be supposed that the mechanical arrangements could be greatly improved; but in the great beauty of the work done, these imperfections are forgotten.

Agate, it will be remembered, is nearly pure quartz, which has been deposited from solution in cavities, not unlike boiler incrustations, so that layers deposited at different times possess unlike density, and often unlike colours. This gives rise to banded agate, fortification agate, and many other beautiful and fanciful designs.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(Continued from page 7.)

Additional Table for Converting the Diamond Carat Weight into Decimal Ounce.

1/64	of a carat	=	1/16	grain	=	0·000103	ounce.
2/64	,,	=	1/8	,,	=	0·000206	,,
3/64	,,	=	3/16	,,	=	0·000309	,,
4/64	,,	=	1/4	,,	=	0·000412	,,
5/64	,,	=	5/16	,,	=	0·000515	,,
6/64	,,	=	3/8	,,	=	0·000618	,,
7/64	,,	=	7/16	,,	=	0·000721	,,
8/64	,,	=	1/2	,,	=	0·000825	,,
9/64	,,	=	9/16	,,	=	0·000928	,,
10/64	,,	=	5/8	,,	=	0·001031	,,
11/64	,,	=	11/16	,,	=	0·001134	,,
12/64	,,	=	3/4	,,	=	0·001237	,,
13/64	,,	=	13/16	,,	=	0·001340	,,
14/64	,,	=	7/8	,,	=	0·001443	,,
15/64	,,	=	15/16	,,	=	0·001546	,,
16/64	,,	=	1	,,	=	0·001650	,,
17/64	,,	=	1 1/16	,,	=	0·001753	,,
18/64	,,	=	1 1/8	,,	=	0·001856	,,
19/64	,,	=	1 3/16	,,	=	0·001959	,,
20/64	,,	=	1 1/4	,,	=	0·002062	,,
21/64	,,	=	1 5/16	,,	=	0·002165	,,
22/64	,,	=	1 3/8	,,	=	0·002268	,,
23/64	,,	=	1 7/16	,,	=	0·002371	,,
24/64	,,	=	1 1/2	,,	=	0·002475	,,
25/64	,,	=	1 9/16	,,	=	0·002578	,,
26/64	,,	=	1 5/8	,,	=	0·002681	,,
27/64	,,	=	1 11/16	,,	=	0·002784	,,
28/64	,,	=	1 3/4	,,	=	0·002887	,,
29/64	,,	=	1 13/16	,,	=	0·002990	,,
30/64	,,	=	1 7/8	,,	=	0·003093	,,
31/64	,,	=	1 15/16	,,	=	0·003196	,,
32/64	,,	=	2	,,	=	0·003300	,,
33/64	,,	=	2 1/16	,,	=	0·003403	,,
34/64	,,	=	2 1/8	,,	=	0·003506	,,
35/64	,,	=	2 3/16	,,	=	0·003609	,,
36/64	,,	=	2 1/4	,,	=	0·003712	,,
37/64	,,	=	2 5/16	,,	=	0·003815	,,
38/64	,,	=	2 3/8	,,	=	0·003918	,,
39/64	,,	=	2 7/16	,,	=	0·004021	,,
40/64	,,	=	2 1/2	,,	=	0·004125	,,
41/64	,,	=	2 9/16	,,	=	0·004228	,,
42/64	,,	=	2 5/8	,,	=	0·004331	,,
43/64	,,	=	2 11/16	,,	=	0·004434	,,
44/64	,,	=	2 3/4	,,	=	0·004537	,,
45/64	,,	=	2 13/16	,,	=	0·004640	,,
46/64	,,	=	2 7/8	,,	=	0·004743	,,
47/64	,,	=	2 15/16	,,	=	0·004846	,,
48/64	,,	=	3	,,	=	0·004950	,,
49/64	,,	=	3 1/16	,,	=	0·005053	,,
50/64	,,	=	3 1/8	,,	=	0·005156	,,
51/64	,,	=	3 3/16	,,	=	0·005259	,,
52/64	,,	=	3 1/4	,,	=	0·005362	,,
53/64	,,	=	3 5/16	,,	=	0·005465	,,
54/64	,,	=	3 3/8	,,	=	0·005568	,,
55/64	,,	=	3 7/16	,,	=	0·005671	,,
56/64	,,	=	3 1/2	,,	=	0.005775	,,
57/64	,,	=	3 9/16	,,	=	0·005878	,,
58/64	,,	=	3 5/8	,,	=	0·005981	,,
59/64	,,	=	3 11/16	,,	=	0·006084	,,
60/64	,,	=	3 3/4	,,	=	0·006187	,,
61/64	,,	=	3 13/16	,,	=	0·006290	,,
62/64	,,	=	3 7/8	,,	=	0·006393	,,
63/64	,,	=	3 15/16	,,	=	0·006496	,,
1 carat		=	4	,,	=	0·006600	,,

With the assistance of these tables, the complicated Decimal Ounce Weights may be dispensed with; every stone or lot be weighed with the more convenient Carat weight, and its weight, or aggregate weights, be converted into Decimals, and expressed as such.

Rules and Tables for Standarding Silver of any Assay Report.

The Standaring of Silver is effected in various ways:—

1st.—By alloying 11 ounces 2 dwts. of Fine Silver with 18 dwts. of Copper for the ordinary Standard or Coin-Silver, or 11 ounces 10 dwts. of Fine Silver with 10 dwts. of Copper for the New Standard marked Britannia.*

2nd.—By adding a certain quantity of Copper to Silver Bullion assayed and reported *Better*, or adding a certain quantity of Fine Silver to Silver Bullion assayed and reported *Worse* than Standard.

3rd.—By mixing certain quantities of two or more different qualities of Silver Bullion assayed and reported *Better* and *Worse* than Standard.

Silver which has been reported up to 1½ dwts. or even 2 dwts. *Worse*, and manufactured into plate, frequently passes the Assay Office as Standard in consideration of the Assayer's Report on *all* the Fine Silver he can find, allowing for a maximum loss of 2 dwts. in the pound troy, subjected to in the operation of manipulating the Assay, which is charged to *that cause*, and not attributed to the apparently defective quality of the silver; it is therefore advisable to calculate the alloying of Standard, or the mixing of Silver of different reports to compose Standard, to 1½ or 2 dwts. *Better* than the Assayer's Report.

Gold is not liable to the same amount of loss from the same *cause* in assaying as Silver, yet a casual loss does occasionally happen, especially when it is necessary to repeat the process of assaying in order to free the Gold from *all* the Silver which had to be added to effect a thorough parting of the metals and refining of the Gold, or to extract any platinum of the Gold Bullion submitted for assaying; and it is therefore advisable to calculate the alloying of any required standard to one quarter-grain *Better* than the Assayer's Report.

Fine Contents and Alloy in Standard Silver.

In order to find the proportions of Fine Silver and Alloy in Standard, the following rule, table, and example, will be of advantage:—

The principle upon which these are determined is this:

"In every mass of Silver, there is $\frac{1}{480}$ part = $\frac{1}{40}$ gr. alloy for every ½ dwt. inferiority to *Fine Silver* in the pound, which in an ounce is one grain."

So that if it is required, how much Fine Silver and Alloy there is *in*, or how much will *make*, an ounce of 222 dwts. fine, the answer is: 18 dwts. 12 grs. fine, and 1 dwt. 12 grs. alloy; for if from 240 dwts. we take 222 dwts., there remains 18 dwts., or 36 ½-dwts., for each of which one grain per ounce being allowed, will give the above answer denoting the alloy, leaving the difference as Fine Silver.

Table of Fine Silver and Alloy in Standard of 11 *ozs.* 2 *dwts. fine.*

		Fine Silver.						Alloy.			
		oz.	dwt.	grs.		oz.		dwt.	gr.		oz.
1 pound, troy, contains		11	2	0	=	11·1	and	18	0	=	0·9
1 ounce	,, ,,	0	18	12	=	0·925	,,	1	12	=	0·075
1 dwt.	,, ,,	0	0	22 1/5	=	0·046	,,	0	1 1/5	=	0·004
1 grain	,, ,,	0	0	0 37/40		..		0	0 3/10		

Table of Fine Silver and Alloy in Standard of 11 *ozs.* 10 *dwts. fine.*

		Fine Silver.						Alloy.			
		oz.	dwt.	grs.		oz.		dwt.	grs.		oz.
1 pound, troy, contains		11	10	0	=	11·5	and	10	0	=	0·5
1 ounce	,, ,,	0	19	4	=	0·958	,,	0	20	=	0·042
1 dwt.	,, ,,	0	0	23	=	0·048	,,	0	1	=	0·002
1 grain	,, ,,	0	0	0 23/24		..		0	0 1/24		

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* This Standard was instituted, and the only Legal Standard for silver, during the period from 25th of March, 1697, to 1st of June, 1720, and called the *New Standard*, and not having been abolished after this period, has ever since that time been left for use at the option of the silversmith; it is, however, not much used for plate in general, except for medals and filigree work.

Example (a).

What proportions respectively of Fine Silver and Alloy will make 740 ozs. of Standard of 222 fine?

dwt. gr. … oz. dwt.
Multiply 18 12 (the Fine Silver in an ounce) by 740 = 684 10 F. S.
,, 1 12 (,, Alloy ,, ,,) by 740 = 55 10 Alloy.
Gross Weight .. 740 0 Stand.

Example (b).

How much Fine Silver and Alloy respectively will compose 615 ounces of New Standard of 11 ozs. 10 dwts. = 230 fine?

dwt. gr. … oz. dwt. gr.
Multiply 19 4 (the Fine Contents in an ounce) by 615 = 589 7 12 F.S.
,, 0 20 (,, Alloy ,, ,,) by 615 = 25 12 18 Alloy.
Gross Weight .. 615 0 Stand.

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Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 11.)

Meanwhile at Perugia, on the piazza, the bronze statue of Pope Julius III., the most important work of Vincenzo Danti, of that city, was finished in 1555, and is of considerable merit. By him also is the group over the south portal of the Florentine baptistery, representing the decollation of St. John. Paolo Ponzio Trebatti ("Maître Ponce"), who worked in France with Primaticco, erected a monument to Alberto Pio, prince of Carpi, which was destroyed, the bronze effigy being now in the Louvre; where are also statues of André Blondel and Charles de Magny, works by this artist. To him also are ascribed two of the bronze figures of cardinal virtues, which were at the angles of Germain Pilon's monument to Henri II. Taddeo Landini was the author of the very elegant "delle Tartarughe" fountain at Rome. Girolamo Lombardo, the son of Antonio di Pietro, who was the head of the Ferrarese branch of that family, settled at Recanati (1534-60), near Loreto, where he established a foundry and executed the four bronze doors of the Santa Casa, works of admirable technical execution and great beauty, representing, on panels, scenes from the life of our Saviour in a manner which partakes somewhat of an earlier and superior character. The three pairs of external doors to the church, also of bronze, were designed by Girolamo, and executed, the central one by his sons; that on the left by Tiburzio Verzelli; that on the right, the southern side, by Antonio Calcagni. These works are of wonderful elaboration, somewhat overloaded in wealth of subject and ornament. The statue of the Madonna and Child over the portal, a fine group, is said to be Griolamo's last work. Calcagni also designed and cast the noble seated bronze statue of Sixtus V., which occupies a commanding position on the marble steps leading up to the church. It was made between 1587 and 1589: the pedestal is enriched with *rilievos* and shields of arms; mannered figures of the cardinal virtues, also in bronze, occupying the four corners.

As, at the end of the fifteenth century, Michel Angelo threw new life into the enfeebled art of his contemporaries, a life not endued with that purer spirit which had inspired the earlier masters, but with a subjectivity almost unfettered, although in the works of his own hands rendered subservient to an all-pervading idealism, so, that at the end of the sixteenth century, Lorenzo Bernini gave an impetus to the flagging energies of the art creations of his time, but in a direction still farther removed from the earnest objective sentiment that had attended the earlier regeneration. Without a shade of Michel Angelo's mighty idealism it travestied his most extreme energy, appealing to the senses, and exciting wonder by *tour de force*, combined with marvellous command of material. In this respect marble seemed as pliant as was in Bernini's hand, and its surface as delicate as ivory. Had he lived in an earlier period, and under the influence of a Perugino or a Donatello, what noble work might he not have done! As the shade of Sansavino pervades the very atmosphere of Venice, predicting the coming fall of plastic art, so in Rome Bernini clouds the sky, crossing one's path at every turn in the form of extravagant architecture or sculpture gone wild. In France he developed the "style Louis quatorze," and its sequent incongruities, which more or less pervaded the whole of Europe, gradually refining at last into the more elegant manner of the period of Louis XVI. This, again, was chilled to death by the cold pseudo-classic style of the "Empire," emanating from the schools of David and Canova-Lorenzo. Bernini was of a Neapolitian family. Born in 1598, he lived to the good old age of eighty-two.

One of Bernini's earlier and better works is the Apollo and Daphne group in the Borghese villa, which was chiselled by him when only in his eighteenth year. A bronze reduction from this wonderfully elaborated marble, probably executed under his own supervision, was sold in London a few years since, and is now in the possession of Mr. H. Danby Seymour. Bronze was, however, comparatively but little used in sculpture by Bernini or the artists of this later time; we must except his *baldacchino*, which surmounts the high altar in St. Peter's, with twisted and fluted pillars, entwined with gilded vine-stems and supporting the huge canopy, all of bronze, richly picked out with gold. This is not merely an architectural work, being adorned with figures of angels, cherubs, &c. The portrait busts of Bernini are, however, fine, although the drapery is generally in a false style. He had many followers, by one of whom is the bronze bust of Pope Alexander VIII. (No. 1089.—'53) in the South Kensington collection; others were Alessandro Algardi, by whose hand is the fine bust at South Kensington (No. 1088.—'53); Francesco Mocchi, and Horatio Albrizio.

We must not omit referring to the huge statue of S. Carlo Borromeo, overlooking the Lago Maggiore from the heights above Arona. The head, which will hold three persons, and the feet and hands are of cast bronze; the figure is a core of masonry covered with beaten copper plates. It was set up in 1697, and is not without considerable merit. The angel in gilt bronze on the top of the castle of St. Angelo at Rome was the work of Giardoni, a bronzist of the last century.

Bronze sculpture in Italy was, however, but little encouraged during the last century, except in the production of ornamental objects and statuettes, copied for the most part from the antique. Giovanni Zoffoli, of Florence, was one of the most able of these bronzists: his vases and statuettes, frequently signed in full, or with the initials G. Z. F., are well executed. F. Rhighetti was also an excellent bronzist working at Rome during the last quarter of the century, as was also G. Boschi. Canova (1757—1822), the leading spirit of the art of his day, produced nothing in bronze, nor has its use since risen above mediocrity.

Among more recent works may be mentioned the monument in bronze to the emperor Francis, which is so prominent an object in the court of the Burghof, at Vienna. It is an able work by Morchesi, of Milan, and was erected in 1846.

The fierce tribes of Germany, who had so well fought for their Fatherland in forest and on rugged mountain-side against the steady advance of Rome's all conquering legions, were equally antagonistic to the progress of Christianity. The altars and sacred groves of their mythological duties were defended to the death, that might open to those wild warriors the golden gates of their Walhalla, where the welcoming nectar draught from the mystic horn would refresh their weariness, and soothe them into bliss.

The eighth century had, however, seen Christianity increase, except in remote regions; and as the Roman armies had advanced, intrenching themselves at every point of vantage, so the missionary of Christ, armed with the sacred message beneath the banner of the cross, steadily progressed and took possession of each converted district by the building of a church and its surrounding monastic establishment. Notwithstanding a period of discord, these fortresses of the new faith increased in numbers, as in riches; for the same romantic devotional sentiment that had influenced the minds of the fierce but simple people to the adoration of Odin, was now directed to the true God and to those who had made Him known. Wealth gradually flowed in, and it is not a little remarkable that its use should have been applied to the production of large works in metal at a very early period in Germany. The bronze gates that adorn some of her churches are of even earlier date than those produced in southern Italy; not, however, as we believe, from any superior artistic power or facility of handicraft, but rather, perhaps, from local circumstances, directed by a comprehensive judgment on the part of the clergy, and applied under extraneous influence. Thus, it is reasonable to suppose that the materials for making bronze, or that alloy itself, would be among the more abundant offerings of such a people, either in the wrought form, or, perhaps, as weapons which had been successfully used in the foray or the chase, and offered as *ex votes* to the shrine. Hence the material, while the many forests would afford a ready supply of fuel requisite for larger operations of the foundry.

(To be continued.)

Trade Notes.

We heartily congratulate Mr. Herrmann on the success which has again crowned his efforts on behalf of technical education for watchmakers. No less than nine students out of ten attending his classes at Charterhouse School have passed the examination of the City and Guilds of London Institute, and two others, who studied his lectures, published in this journal, have been equally successful. The following is an extract from the

Pass List of the City and Guilds of London Institute for 1882.

	Honours.	Ordinary.	Prize.
Bath Street Board School:— (I. Herrmann's Class, Charterhouse).			
Bishop, Francis Harden ..	—	1	—
Bontoft, Robert Johnson ..	—	2	—
Bray, James	—	1	3rd. £2. Bronze Medal.
Craighead, William	1	—	—
Gosling, James	2	—	—
Harvey, Albert	—	2	—
Hesk, Edward	2	—	—
Peek, William	—	1	—
Wright, Thomas D.	1	—	—
Cowper Street School:—			
Spiegelhalter, Edmund ..	—	1	—
Agget, John	—	1	2nd. £3. Bronze Medal.
Herrmann, Ignaz	1	—	2nd. £5. Bronze Medal.
Liskeard:—			
Huddy, William	1	—	—
Plymouth:—			
Thomas, Ernest Charles ..	—	2	—

On Saturday the 29th ult., two men, Undine and Kircher, were charged at Marylebone Police Court, before Mr. Cooke, with defrauding Pawnbrokers by pledging brass "nuggets" coated with gold.

P. Vaughton & Sons, the well-known Birmingham firm of Jewellers and Medallists, have just issued a new illustrated list of Medals, Badges, &c., which is the best thing of the sort we have seen, and we strongly advise all Dealers, Secretaries of Clubs, and other persons interested in Sports and Exhibitions, to apply at once for one of these lists, which the firm forward post-free. Messrs. Vaughton & Sons have lately turned out some very fine specimens of the Medallist's Art, notably the Medals for the Birmingham Football Association, Birmingham Cricket Club, Aston Villa Football Club, Speedwell Bicycle Club, and others too numerous to mention.

Diving for black pearls employs a large number of men and boats off the coast of Lower California. Traders supply the vessels and diving apparatus upon the stipulation that the pearls that are found are to be sold to them at specified rates. These jewels are of much beauty, and highly prized. A year's production is worth, on an average, from 500,000 to 1,000,000 dollars.

We have been requested to acknowledge the following donations towards the funds of the Watch and Clock Makers' Pension Society:—J. U. Poole, Esq., Treasurer, £2 2s.; The Manufacturing Gold and Silversmiths' Company, 112, Regent Street, W., £2 2s.; A. F., £1 1s.

At the last meeting of the Académie des Sciences an account was given by M. Roscoe of some curious experiments recently made into the nature of the "Cape diamonds." After the first enthusiasm, excited by the discovery of these diamond fields, a re-action set in, as it will be remembered, to the detriment of the new industry, on account chiefly of the inferior colour noticed in almost all of the diamonds. Instead of the purity for which the best stones are most highly prized, the African diamonds showed tints of various colours, most usually some shade of yellow, but also occasionally pale violet, resembling the amethyst, light green, or even smoky patches. Another grave complaint against them was found in their real or supposed propensity to burst in pieces with little or no provocation. The wise men have long declared that both these defects must be due to the admixture of some baser substance with the material of the diamond; but the theory, however plausible, has remained a theory only, unconfirmed by anything in the shape of a practical argument. The difficulty which beset the experimentalists is intelligible enough. They were not disposed to lay out their money in the purchase of such expensive toys for the purpose of destroying them in the unselfish desire to benefit chemical and geological science. This was a matter in which the well-known maxim, *fiat experimentum in corpore vili*, was altogether inapplicable; and until M. Roscoe put his hand to the work, the mystery was never fairly cleared up. This gentleman set to work by burning Cape diamonds in oxygen, by which process the true stones vanished gracefully by transformation into carbonic acid. But the Cape products, instead of completely disappearing in this quiet fashion, have been found to leave behind them a sort of ash, or residue, which is incombustible in oxygen. What the residue consists of he is not yet in a position to say. But it is something to have proved that the essential virtue of the diamond remains free "from a stain on its character," the blemishes being due, not to any vice in the stone itself, but only to its having been corrupted by evil communications.

Our readers are probably aware that Mr. Joseph Savory, the senior partner in the Goldsmiths' Alliance, of Cornhill, has been elected to the office of Sheriff of London and Middlesex for the year ensuing. A fitting opportunity is presented to the trade to do honour to one of their craft, upon the occasion of his taking upon himself the duties of his high office. We hope that a committee will be formed to consider how best to recognise the advent to public life of the present representative of one of the oldest and wealthiest of London Gold and Silversmiths' firms.

At a recent meeting of the Physical Society, Berlin, Prof. Christiani exhibited as samples of a new method of preservation a series of organic bodies coated galvanoplastically. A mulberry leaf, a crab, a butterfly, a beetle, the brain of a rabbit, a rose-bud, and other objects, were plated with silver, gold, or copper, and showed all details of their outer form, down to the finest shadings. As to the process, it was stated that the objects to be preserved being put into a solution of silver nitrate in alcohol, then dried and treated with sulphureted and phosphureted hydrogen, form good conductors, which, brought in the usual way into the galvanoplastic bath, can be coated with any desired thickness of a metallic deposit.

M. Louis Ruhl of Pforzheim (Germany) has just issued the third edition of his useful *Führer durch die Bijouterie Fabriken* (Guide to the manufacturing jewellers and allied branches of Pforzheim, the centre of the German jewellery manufacture. Mr. H. Bush, of Hull, is the English agent for the work.

A List of Watches, Watch Movements, Clocks, &c.

The Property of the Worshipful Clockmakers' Company, and Deposited in the Guildhall, London.

(Continued from page 14.)

Hubert, Jean, à Rouen.

125. Metal Single-case Watch, enamel dial, formerly part of a timepiece.

Huggerford, Ignatius, Londini.

A Freeman of the Haberdashers' Company, admitted and sworn a Brother of this Company, July 3, 1671.

126. Silver Watch, with tortoiseshell outside case, mounted and studded with silver, silver dial, with rotary day of the month circle.

This watch has a steel cock beautifully pierced; it is remarkable for having a jewel in the cock, and was produced before a Committee of the House of Commons, about 1704–5, to oppose the application for the grant of a Patent for jewelling watches and clocks. The opposition to the Patent was made at the expense of the Company, and was successful, as appears by a document in the handwriting of Edward Tutet, Master, dated 1785, and in possession of the Company. Purchased by the Company of Henry Magson, for £2 10s., January 15th, 1804.

Hughes, William, London.

Apprenticed May 7, 1787.

127. Jewelled centre, seconds movement, capped with enamel dial, square pillars, and beautifully engraved cock and name-piece. No. 4113.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Hunter, Thomas, London.

128. Vertical Movement, enamel dial, in green-skin case, gilt. No. 768.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Huntt, Edward.

129. A fragment of an Ancient Movement, with tulip pillars.

Presented by George Philcox, 1875.

Jackman, Joseph, London Bridge.

130. A large Vertical Movement.

Julliott, Sol., London.

131. Vertical Movement, No. 413. Date on mainspring, 1738.

Presented by Messrs. F. B. Adams & Sons.

Kendall, Larkham, London.

132. Silver Watch in pair of cases, B. & V., very curious and elaborate Remontoir escapement, coiled up compensation curb.

Purchased at the late Larkham Kendall's sale, by the late Benjamin Vulliamy, for £30, and presented by his son, B. L. Vulliamy, 1849.

Knibb, John, att., Oxon.

133. Vertical Movement, with curiously wrought pillars, no dial.

Presented by F. Putley, 1816.

Laing, David.

134. Vertical Movement, of an early period; remarkable for its very peculiar cut pillars and its mode of fixing in case. Hour hand only.

Presented by Edward Streeter, 1875.

Le Count, Daniel, London.

Made Free of the Company, 29th September, 1676.

135. Vertical Movement, No. 197, with tulip pillars, no dial.

Le Noir, à Rennes.

136. A Metal Gilt Watch, with enamel dial, and raised spaces for the hours. One hand only; winds up by cannon pinion, the outer case engraved and gilt.

Presented by C. H. Iverson, 1875.

Lepine, Horloger du Roy.

137. A Silver Watch, with enamel dial, central seconds, lever escapement.

138. A Plain Vertical Movement, with enamel dial, No. 1612.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Le Roy, Julien, à Paris.

139. Vertical Movement, No. 2721, no dial, curiously pierced gold hands.

Presented by B. L. Vulliamy, 1849.

140. Plain Vertical Movement, with enamel dial and diamond hands, No. 13,958.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Leroux, J., Charing Cross, London.

141. Gold Watch, in pair of cases. Very complicated and highly-finished escapement.

Presented by Admiral Lord Lyons, 1859.

Lestourgen, David, London.

David Lestourgen, Watchmaker, admitted a Free Brother, April 4th, 1698.

142. Gilt Movement, No. 1386, enamel dial. A very good specimen.

Presented by F. B. Adams, July, 1869.

Lindesay, G., "Servant to His Majesty," Watchmaker to King George II.

143. Vertical Movement, jewelled, enamel dial, No. 627.

Margetts, George.

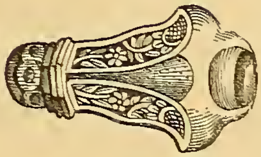
Admitted a Free Clockmaker, October 11th, 1779; and to the Livery of the Company, October 7th, 1799.

144. A very large Watch, in metal gilt case, with enamelled back, showing mean time and sidereal difference in hours, minutes, and seconds, by three revolving enamel discs, horizontal escapement, No. 1098.

Presented by Charles Frodsham & Co., 1875.

(To be Continued.)

ANTIQUE RINGS AND ORNAMENTS.



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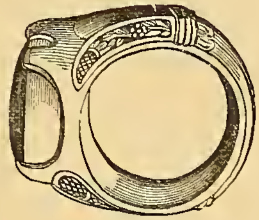

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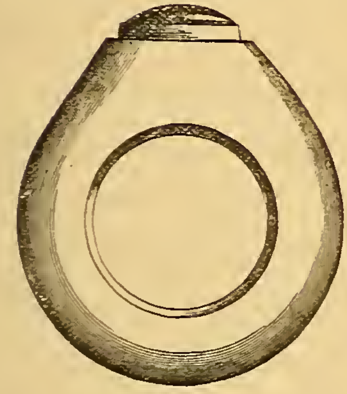

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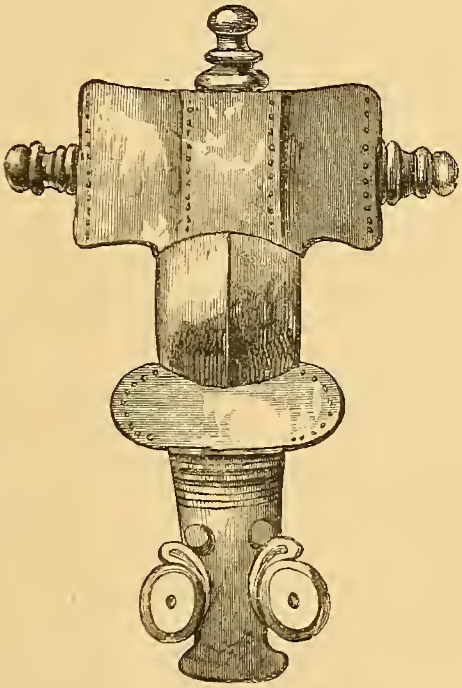

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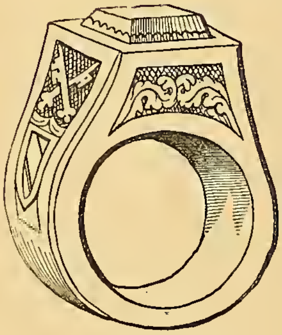

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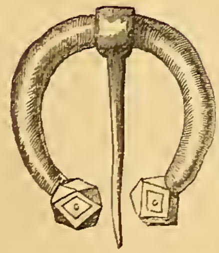

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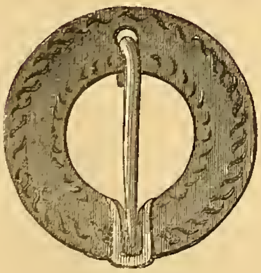

59.

For Description see page 17.

THE
WATCHMAKER
JEWELLER
AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.
Entered at Stationers' Hall. Registered for Transmission Abroad.

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ILLUSTRATED SUPPLEMENT :— Design for a Three-Handled Loving Cup.

No. 88.—Vol. VIII.] SEPTEMBER 5, 1882. [Subscription, 5s. per Annum. Post Free.

Our National Watch Factory.

By a Horological Zadkiel.

(Continued from page 17.)

Jonathan (as our friend will be designated in future) had scarcely uttered the remark recorded last month, when he was accosted by a gentleman who introduced himself as Mr. A. Compensation, chronometer maker, of Barbican, and a director of the National Watch Company. He had been to the docks on nautical business, *via* the Regent's Canal, City and Docks Railway, and while waiting at the hotel was attracted by the evident interest taken by J. in the report he was reading. The latter was easily persuaded to vary the return route by accompanying the director to the terminus at Barbican, in which vicinity several chronometer houses had been recently opened, in consequence of the facilities of access to the various docks, provided by the new railway and its branches.

During the journey the conversation naturally turned upon the prospects of the new factory. J. wanted to know why it had not been started years before, but was informed that, although the topic had been fully discussed in trade journals and, to a limited extent, in the public press, it had not until the last few years been taken up by truly representative men who could claim to be termed leaders in the trade, and that consequently capitalists held aloof from the venture. At length several gentlemen were induced to take a prominent lead, and it was not long before general support followed.

The terminus having been reached, J. proceeded to his hotel, where he found a card of Mr. J. Turner Pivot awaiting him, on which was stated that its owner would call the following morning at ten o'clock and escort him to the factory. After dinner he visited the Young Men's Christian Institute, the members of which met at the building known in former years as the Royal Polytechnic Institution, where he was much interested in the lecture given by the teacher of the Watchmakers' Technical Class, the largest in the country, and the pupils at which had greatly distinguished themselves at the examinations of the City and Guilds Institute.

Before leaving, he made an examination of the building, and then returned to the hotel to enjoy some well-earned repose.

Ten a.m. found Mr. Pivot punctual to his appointment, and J. was equally prepared to accompany him; so they at once proceeded to the factory, where upwards of 500 *employés* of both sexes had been busily engaged for an hour and a half previously.

The building itself was ⊥ shaped, thus securing the requisite frontage, and affording means of extension in the rear at a future time.

But for the size of the windows and the commodious entry in the centre, it presented the appearance of a block of artisans' dwellings, and would scarcely have attracted the attention of the passers by, but for the fact that the steam engine which supplied the motive power was exposed to view, and proved a most attractive advertisement.

It was of 35 horse-power, and turned upwards of 3,000 feet of shafting at a uniform speed of 218 revolutions per minute. All the lessons designed to be taught by the Smoke Abatement Exhibition held in 1881-82 had been fully carried out, and the consumption of fuel had been reduced to a minimum. It might appropriately be termed the "heart" of the establishment, inasmuch as any irregularity would at once affect the entire machinery. The engineer especially prided himself on the capabilities of his charge, and it was amusing on one occasion to witness his indignation when a critical on-looker insinuated that a crank was in danger of "buckling."

Leaving the engine to proceed with its monotonous though indispensable task, J. was next conducted to the secretary's office, where he found that indefatigable individual busily engaged in attending to the morning's correspondence; and a very varied correspondence it was. Three-fourths of the letters were from country watchmakers requiring single watches, and also materials of every description; this branch having been made a special feature of, as experience showed, an increasing desire on the part of small retailers to deal with large firms, who by their position were able to manufacture and buy to the best advantage.

One of the rules of the company was especially worthy of notice, viz., that they never undertook the responsibility of making a defective watch (not their own make) to "go," but only supplied the required pieces, leaving the other part to the retailer.

Fully a hundred hands were employed in the jobbing department, under experienced supervision, in addition to which a large quantity of work was given out to workmen, whose long habits of working at home rendered them disinclined to conform to the regulations of a factory.

The company also received many orders for watches of a description that they did not pretend to actually manufacture by machinery, and which afforded occupation to many small masters carrying on business in Clerkenwell. Owing to their shipping arrangements with all parts of the world, they afforded unusual inducements for colonists and others to order single watches made on the old system, without incurring the difficulty and risk usually connected with sending them out; thus, in point of fact, they concentrated and gave a fresh impulse to the entire English watch trade.

These watches were tested in a most thorough manner, and the guarantee of the two practical directors, Mr. A. Compensation, and Mr. J. Turner Pivot, carried as much weight as an Observatory certificate. Returning to the original object of the factory, viz., the manufacture of watches for the million by machinery, J. was reminded that the company possessed very great advantages in starting, as they were able to avail themselves of all the experience, and to avoid the mistakes, which had been gained or made by the existing American and English companies or firms.

Formerly a large proportion of the capital was sunk in designing and constructing machines, which subsequent improvements rendered useless; but the company, having once decided on certain models, determined to stick to them, leaving variations of style to be worked out in the old methods. Also they enjoyed a great advantage in not having to incur the responsibility of finding homes for their work-people, as in the case of several of the leading American factories; for, although the contrary had been stated by high authorities, it had been proved that living was as cheap in London as in any other part of the country; therefore skilled workmen, English or foreign, did not require special guarantees before entering the employment of the company.

Jonathan kept up a running comment of agreement during the recital of the foregoing details, and then proceeded to inspect specimens of the tools employed previous to seeing them in actual operation. These included the best forms of the Mosely and Whitcomb lathes, with their innumerable attachments, Universal heads (answering to the English or Swiss Mandrels), Swiss Jewelling lathes, Jacot pivot lathes, Wheel and pinion-cutting machines, grinding and polishing machines, wheel punches, dies, &c., &c., fuller descriptions of which will be given next month.

(*To be Continued.*)

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 21.)

> "There is a general demand for anything affecting a guard against accident to the centre pinion, and every thinking manufacturer ought to make this an object of his reflections. Still, it seems the right thing is not found yet."—M. Grossmann.

Safety Pinion

Is the name given to a combination, the object of which is to prevent injury to the train, occasioned by the violence of the return action, which takes place when the mainspring breaks near the eye immediately after it has been wound up to the top. You will notice that when the teeth of the going barrel and centre wheel are bent or broken through the breaking of the mainspring, they are invariably bent or broken in the opposite direction in which they travel in their normal condition. When the mainspring breaks near the hook (*i.e.*, the end attached to the barrel), the great power of the mainspring is immediately diminished, and the remaining power is gradually discharged in the direction of the regular tension of the spring, just like the buffer in a railway carriage that has been struck (wound up) by the engine.

Doubtless this idea of a safety pinion is purely an American conception; I have heard it said that it is the most valuable contribution they have made to horological art. Concerning it, this is the tale they told me there: "About twenty years ago, when we first began to make watches, our escapements were not what they are now; they were rough, heavily-pivoted frictional affairs, and in order to get a good vibration to the balance, we had to put very strong mainsprings to our watches. The result was, when the mainspring broke we frequently found the barrel or centre wheel stripped of some of their teeth, and even the pivot of third wheel and jewel hole broken; and we were made to feel that our watches were little better than mechanical suicides, which were liable at any moment suddenly and without ceremony to put an end to themselves. To remedy this state of things many suggestions were made; among others Mr. Stretton introduced his patent going arbour as a substitute for the going barrel, but it was found too complicated, and the great friction on the pivots renders the going arbor inferior to the going barrel as a transmitter of power; and just when a large plant of expensive machinery had been completed to manufacture Stretton's patent arbor, Mr. Fogg invented the safety pinion, which permanently restored the going barrel to favour." Fogg's pinion, as most watchmakers know, consists in forming a *right* or *left*-hand screw, with triple thread, on the arbor or axis to which the centre wheel is riveted. If the centre wheel is below the barrel, as in an English watch, a *left*-hand screw must be used; but if the centre wheel is above the barrel, as in a Geneva watch, then a *right*-hand screw must be used. A loose pinion nut is screwed on the axis, which is kept in its place by the tension of the mainspring, and so transmits power to the train, but immediately the reverse action takes place the pinion is unscrewed and is powerless to injure the train. The object of the triple thread is to increase the pitch* of the screw, and at the same time preserve a fine theread for the purpose of diminishing its binding power. The pitch or climb of the screw in centre pinion of a 14 size Waltham watch is about fifty threads to the inch, and the diameter of the screw is about one fiftieth of an inch: the result is, it will not bind tightly, and easily unscrews. It is a fact worth remembering, that the more you increase the diameter of a screw, of a given pitch, the more you increase its binding power, and *vice versa* The construction and machine work in the centre pinion of an American watch is a proof of engineering skill, of which, as a nation, they may well be proud. But I venture to suggest it has at least one fault, viz., it militates against flatness. The distance the pinion nut travels before it is released from the teeth of the barrel occupies valuable space, and the result is in a watch already too bulky, they have to make the barrel teeth much too narrow. I mention this fact, not to depreciate what Americans have done, but to give an opportunity of improving upon their ideas; and this will be no easy task, for the Patent Office at Washington has been besieged with safety pinions. I have not space to examine them here.

It is sometimes instructive, and always interesting, to hear men of different nationalities speak upon a given subject. Having canvassed Clerkenwell for opinions respecting a safety pinion, will you listen to the tale they told me there. The first gentleman whose opinion I will give is the representative of one of the oldest and largest houses in Clerkenwell, who make up best work. He says, "It is not compatible with the dignity of a Clerkenwell watch manufacturer to adopt a Yankee notion, no matter how good it may be." The second opinion is from one of the esteemed vice-presidents of the British Horological Institute, who says, "A safety pinion is a rot; there is no necessity for it. Look here" (holding up a *fusee* movement), "if the mainspring breaks twenty times, the great wheel teeth will not be injured." The third, also a vice-president of the Horological Institute, says, "There is no necessity for a safety pinion; I have made going barrel watches for thirty-five years, and I never met with an instance of damage to the train through a spring breaking in one of my watches." Fourth, speaking at a meeting of the National Chamber of Trade, a Clerkenwell watch manufacturer said, "Americans have what they call a patent safety pinion, but he thought it would not operate, because when the mainspring was wound up it would tighten the pinion on the arbor, so that it would not be unscrewed by the recoil." Comment is unnecessary.

The subject upon which I write has already received the attention of an eminent German watchmaker, and some suggestions he has made in the pages of this Journal, Vol. VII., pages 67, 78, 92, require reconsideration; *e.g.*, he says—"I should not advise the use of this safety apparatus, because I think it will fail by the inertiae of the parts between the third wheel and the mainspring. The destruction, by a sudden jerk, will be completed before its power reaches the third wheel, in like manner as the blast powder in a hole made in solid rock and stopped up with a little clay, will split the rock by its sudden action before it has time to drive out the small stopping." He does not sufficiently consider the nature of the different substances to which he refers; metals, especially brass and steel, have powers of endurance that stones have not. It is the nature of brass and steel to *bend;* it is the nature of stone to *rend,* and I am prepared to assert that the strength and pliable nature of the metal will be more than sufficient to overcome the shock, detained by the inertiæ of the parts between the barrel and third wheel. I imagine I hear the reply, "The amount of bend in the parts referred to is very small." I grant it is small, but, nevertheless, it may be sufficient. It may be immeasurably small, and therefore beyond our comprehension, and yet it may be sufficient to operate with perfect safety. Objections of this kind *pro* and *con* are capable of indefinite extension; how can we settle them? Where will the controversy end?—At the tribunal of experiment.

Again, the same writer says, "Besides this arrangement, if it should have any chance of success, must have the spring exactly regulated so that it does not yield to the pressure of the mainspring when fully wound, but any pressure beyond this makes it slip over. If this be not the case, the safety of the pinion will not be attained." And in another place he embodies the same idea.

"Besides this there is no saying from which side the shock of the breaking spring may come. If the spring breaks near its outer end, the shock will apply in the way of the regular tension of the spring and the safety apparatus will not be of the slightest use; on the contrary, the pinion weakened by the large hole will stand a poor chance. It will only be effective in case of the spring breaking near its inner end."

Here, I fear, there is a serious mistake, which I hope does not arise from being hypercritical, or shew a willingness to criticise too severely. In examining an invention, we must be careful not to demand more than is required; for in so doing we injure all parties.

When the spring breaks near the outer end, the small piece attached to the rim of the barrel immediately flies back, and has a slight tendency to reverse the action of the barrel. The remainder will discharge its power in the way of its regular tension, but the force will be greatly diminished. The great *strain* of the spring having gone, the *stress* will go with it. The strain is the stress; both go together. There is a point in the spring near the middle, at which, if it breaks, the two contrary forces will exactly nullify each other. The most aggravated form of shock in the way of regular tension is not when the spring breaks near its outer end, but when the outer end slips over the hook in the rim of the barrel. But if the general conditions of the great work are sound, no serious damage will arise from slipping over the hook, much less will there be damage when it breaks near the hook.

The parts to which I have referred in Mr. Grossman's article appear to me unsatisfactory, and if their esteemed author lives as long as I hope he will live, he will have abundant opportunity of correcting them.

I am agreeably surprised to read that, "some years ago Mr. Grossman had in hand a safety pinion of English make, it appears that it was made with a staff, on which the pinion was screwed with a three-headed* screw, tapped into the hole of the pinion." It appears from this description to be similar to the pinion now used in the Waltham watch. I have not seen one of this description made in England, and have made enquiries of workmen much older than myself, and can find no trace of such an invention in this country. But should any reader be able to confirm Mr. Grossman's statement, I shall esteem it a great favour if he will communicate with the editor of this journal.

Richard Whittaker.

(*To be continued.*)

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Erratum.—In foot-note, p. 16, read *November* for *December*.

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* "Pitch of a screw" is a phrase well understood by engineers, but as it is rarely used by watchmakers, I may explain that it means the distance between the threads of a screw measured on a line parallel to the axis. It is the climb of the screw, or it is the distance the screw travels in one revolution.

* Three-headed screw. Is this a misprint? Should it not read *three-threaded* screw? Does it mean a triple thread of increased pitch, such as I have described? This word renders the entire paragraph obscure. Will the author kindly enlighten us?

The Worthies of Horology.

By C. Stuart Murray.

V.

DURING the period to which my last paper related, there were, contrary to the information of many of us, clocks that went both by weight and spring. This is merely explanatory of what has gone before.

Nearly every horologist has heard of "The Great Clock of Strasburg," but many may not be aware that the present-day one is the *third* that has performed in the face of history. The first one is said to have been made in the year 1370, but of that a divergence of statement will be referred to presently. It was twenty feet high, but the crowing cock of its curious parts is all that can now be found of it. It was placed in the cathedral upon stone brackets, which latter can still be seen as they were originally built into the cathedral wall. The case was a wooden one, put together according to the fashion of the carpentery of the period. The clock, along with many other "curios," which I cannot stop now to describe, had a picture beneath which was painted a set of German rhymes, setting forth the wondrous influence of the "seven planets," as laid down by astrology; but what the names of those powerful seven planets were was not stated, and we have now no means of knowing. There was a calendar indicating the moveable feasts, as the clock mechanism went on, and an astrolabe for showing the motions of the sun, moon, and stars, as well as the hours and minutes. The astrolabe, as an instrument, was used as a mechanical method for the assemblage of the several circles of the sphere in their proper order with respect to each other; in fact, much the same as is the modern armillary sphere. The old form had the earth in the centre, whilst the celestial horizon, ecliptic, and other circles enclosed it, so as to give an approximate idea of certain astronomical motions. The name astrolabe is formed of two Greek words, meaning "taking the stars," because the positions of the heavenly bodies were said to be taken by it. It had index circles to denote both horizontal and vertical angles.

In the Strasburg clock the motive power and the train were in contiguity to the astrolabe, which elevation was also enriched with a statuette of the Virgin. Before her the three Magi, or Wise Men of the East, turned out at noon and bowed most reverentially. Then came the cock, which still lives as the last survivor, and crowed and flapped his wings right gallinaceously, beating time with his beak. There was, besides, a set of chimes, which completed the clock. Charles Schwilgue, of Strasburg, to whom I am indebted for some of these particulars, says that after long and patient search he has been unable to discover who the horological "Worthy" of this clock was. All that is known is, that it was two years in making, and that it came into existence "under John, Bishop of Lichtenberg."

With respect to the date of the construction of the second Strasburg clock, there seems to be a considerable divergence among the authorities thereon. Professor Hamberger fixes it about the year 1370, coupling the name of Dasypodius[*] with it. Furthermore, he mentions the clock of Courtray "about the same period," which I shall speak of further on. Upon the other side we find Charles Schwilgue, at Strasburg, in 1844, saying that the second clock dates from 1547! He tells us that that clock had for its authors and constructors a whole troop of "Worthies." There were Dr. Heer, Bruckner, Herlin (an eminent professor of mathematics at the University of Strasburg), Dasypodius, and Volkenstein, the astronomer of Breslau; two brothers of the name of Habrecht being the "smiths," who also had charge of it for some time afterwards.

> "And because this clock cannot
> Go of itself, nor move at all,
> If there is not some one to keep and take care of it;
> Therefore it must have to keep it in order
> A clocksmith who, early and late,
> Diligently attends and regulates it,
> Draws up the weights again, and sets them to their duty,
> And thus makes them move regularly,
> Moderates and regulates the wheels,
> And puts them in order, so as to strike."

Here was a disagreement of doctors with a vengeance! and if they doubted, it need not be wondered at that we should; but a difference of one hundred and seventy-seven years is no joke; and both dates, too, being backed up by strong circumstantial surroundings. However, as Schwilgue is the latest digger in this horological treasure-ground, and gives us more particulars than the professor, it will be, perhaps, the better way to follow him, notwithstanding the wide gap in the disagreement of dates.

The learned men who have been named above engaged several first-class artisans in clockmaking to carry out the original designs; but the deaths of Dr. Heer and his friend, Nicholas Bruckner, left Professor Herlin bereft of their valuable assistance. Other unpromising and unforseen circumstances broke in and stopped the progress of the work. This interruption, says Schwilgue, happened at the moment when the mathematicians had just finished the design for the astrolabe, and when the stone masons were putting the finishing stroke to the clock chamber, and the iron cage had been got ready to receive the clock train. The work having been brought to a standstill, it remained suspended until the year 1570, a period of nearly three and twenty years. Then came Dasypodius upon the scene, of whom, following our modern guide, we shall now offer some biographical particulars.

Conrad Dasypodius was born at Strasburg in the year 1531, and was the son of Peter Rauhfuss, a learned Greek scholar of Frauenfeld, in Switzerland. Having come into the world under such an intellectual star, it may be readily understood that the young Conrad would be blessed with a good share of high-class learning. One of the first ways in which he turned his learning to personal account was that of changing his name. Rauhfuss in German signifies "hairy-foot," and the ingenious youth, putting the Greek words *dasus* and *podos* together, manufactured *Dasypodius*, and thereby grandified the German name into a classic patronymic, *dasus* being "hairy," and *podos* being "foot." That may have been an indication of the distinctive honours that were to follow. The now Conrad Dasypodius showed such a marked ability for mathematical learning, that his father encouraged him, instead of endeavouring to force him into the critical study of Greek literature. He became a pupil of the famous Christian Herlin, the professor already mentioned, who took a great liking to him. Conrad, on the persuasion of his master, entered holy orders, which at that day was the principal road to power and fortune. In 1562 he succeeded Herlin, and became a minor church dignitary. In 1566 he suddenly found himself famous by the publication of his "Commentaries on the First Books of Euclid," which at once became the standard topic of mathematical conversation. He afterwards gave a description of the design of the great clock of Strasburg Cathedral, with which his name was to be so long identified. He subsequently rose to be Dean of the Church, and died in 1601, having nearly reached the age of "three score years and ten." Turn we, now, to his important work.

He did not follow in the construction of the clock the exact plan of those who had worked at it before him. He designed for a much larger combination of parts, and was not satisfied with what he had done until it had received the imprimatur of the distinguished mathematicians known to him. He then took into his confidence and his service the brothers Isaac and Josiah Habrecht, clockmakers, of Schaffhausen, Switzerland. They had already acquired a reputation in their trade by the construction of a complex astrolabe, and an astronomical sphere. One of their townsmen, Tobias Stimmer, was "taken on" to do the paintings and the sculptures which were to be attached to the great work. They had scarcely got into harness, when Dasypodius began to break down from exhaustion; not exactly on account of the toil over the construction of the clock, but from other matters that he had in hand. He sent for his friend, David Volkenstein, who was then at Augsburg, and the latter immediately hastened to his aid. The work then went on conjointly, and in June, 1574, the clock was set going; but it was not quite finished until some years afterwards. There was a painful tradition current for a long time in that country, namely, that one of the Habrechts had his eyes put out by order of a magistrate, so that the chief artist of the Strasburg clock should never make another like it. This, fortunately, like many other traditions, rested on an utterly false foundation, no such act of cruelty having ever occurred. Schwilgue goes on to say, on being referred to again, that the clock continued going until 1669, when it was restored by another Habrecht, a grandson of one of the original makers. A second restoration took place by a kinsman of the Habrechts, named Straubhaar, and their successor, in 1732. In 1789 the career of this famous clock came to an end, so far as Strasburg Cathedral was concerned at least.

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[*] Iac. von Königshovens Elsass und Strasb. Chronik, p. 574.

We have said that Conrad Dasypodius was a dignitary of the Church, and that fact brings up a whole train of others. When one comes to inquire into this part of our subject, we find it somewhat astonishing, and a great feather in the caps of good Churchmen, to learn the number of clergymen who, in one way and another, have been Worthies of Horology. From the earliest advent of escapement timekeepers we have read that such was the case; and where not clergymen, they have been more or less directly connected with the religion of the age. For instance, in the Book of the Prophet Isaiah, chap. xxxviii., v. 8, mention is made of the dial of Ahaz; some particulars will be found in a previous paper.

When the Roman Catholic religion ruled Europe, and trained nearly all its brain-power, the working of that power was found to exist in the monasteries, and its practical application largely took the direction of horology. Thus there was Pacificus, Archdeacon of Verona, "celebrated" for having made a clock in the early part of the ninth century. In a long Latin epitaph upon his tomb there are four lines—verses they are called in Latin—extolling his connection with horology. Gerbert, another monk, who lived towards the close of the tenth century, is credited with being a horological "Worthy." He is said to have made a clock at Magdeburg, taking the pole-star for his guide, during his exile, for the German Emperor, Otho. A few biographical words about this ancient Worthy of Horology will be read with interest here.

Gerbert was born in the year 920, at a small village named Belliac, in the province of Auvergne, France. His parents were poor peasants, so poor that as soon as he was old enough he was sent into the mountains as a shepherd boy. This occupation acted upon the astronomer, Ferguson, under similar circumstances; it set him studying the stars when with his flocks at night. Following up his star watchings, he attracted the attention of Father Raymond, a Benedictine monk of the monastery of St. Gérald, who took charge of him, and had him entered as a novice for a regular education. Here he had nothing else to do but learn under the best kind of teaching of that day, and in a few years developed such a mathematical mind as to surpass his instructors. Borel, the Count of Barcelona, happened to be on a pilgrimage at St. Gérald's, and was so attracted by the attainments of Gerbert, that the youth was taken to Spain, then under the dominion of the Moors. From Barcelona he went to Cordova, where he had the good fortune to fall under the influence of the Moorish prince, Abdel-Rahman III., who devoted an enormous income to the promotion and encouragement of science in every way. Gerbert benefited largely by attending the lectures of the learned in this city during a four years' sojourn. He formed many valuable friendships. Passing from here to Grenada he found Count Borel, who took him to Rome and introduced him to Pope John the XIIth. At Rome he was presented to "Otho the Great," emperor of Germany, for whom he made the clock, as already stated, in the year 996. He went to Paris, visited the principal cities of France, and became a learned European personage of distinction. He ultimately ascended the Papal throne under the title of Sylvester II., and had written what was then a valuable work on the construction of sun-dials, under the title of De Astrolabio. In the sixteenth century there were the Fathers, Schoff and Kircher, both of whom studied horology; and there was that abbot of St. Alban's, of whom some particulars have been previously published.

In the memoirs of the Royal Academy of Sciences, Paris, of 1729, there is a full account given of Truchet, another clergyman, who was superlatively skilled in the construction of automata; so skilled, in fact, as to strain the credulity of the observer to the utmost; and there was Vailly, the inventor of the modern water-clock. Then there was Thiont, a Vicar of St. Cyr, author of the *Traité d'Horlogerie*, Alexandre, who wrote the *Traite-General des Horologes* in 1734. Among such a brilliant gathering there is the English Derham, whose *Artificial Clockmaker* has been honoured by being translated into both the French and German languages.

Horology has a peculiar fascination for men of studious habits and cultivated minds; it need not, therefore, be wondered at that clergymen, especially, having had the benefit of a mathematical education, when, happily enjoying lettered ease, should be captivated by the mechanical witchery of horology. The Rev. H. L. Nethropp gave us a "Treatise on Watch-work," in 1873, and we have seen that Dasypodius, of the great Strasburg clock, was also a clergyman. About the mechanical action of this clock I hope to be able to say something in my next paper.

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The First Striking Clock.—In the time of Alfred the Great, the Persians imported into Europe a machine which represented the first rudiments of a Striking Clock. It was brought as a present to Charlemagne from Abdallah, king of Persia, by two monks of Jerusalem, in the year 800. Among other presents, says Eginhart, was a horologue of brass, wonderfully constructed by some mechanical artifice, in which the course of the twelve hours *ad clepsydram vertebatur*, with as many little brazen balls, which, at the close of each hour, dropped down on a sort of bells underneath, and sounded the end of the hour. There were also twelve figures of horsemen, who, when the twelve hours were completed, issued out at twelve windows, which till then stood open, and returning again, closed the windows after them. It is to be remarked that Eginhart was an eye-witness of what is here described, and that he was an Abbot, a skilful architect, and very learned in the sciences.—*Watson's Dissertation on the Introduction of Learning into England.*

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

BY H. BUSH, HULL.

(Continued from page 24.)

Table for Standarding Silver of superior Fineness or reported BETTER.

As Silver *above* Standard is never reported *pure*, or 18 dwt. Better, the table will begin as used in practice, with report Better 17 dwt. For the *difference* of Standard contained in an ounce of Silver Bullion, reported *Better*, add the *same quantity* of Copper as Alloy per ounce, to reduce the *mass* to Standard.

			oz.	dwt.	gr.	
1 oz. of Silver, reported *Better*	17 dwts.	contains	1	1	$12^{28}/_{37}$	Stand.
1 ,, ,, ,,	16½ ,,	,,	1	1	$11^{25}/$,,	,,
1 ,, ,, ,,	16 ,,	,,	1	1	$10^{22}/$,,	,,
1 ,, ,, ,,	15½ ,,	,,	1	1	$9^{19}/$,,	,,
1 ,, ,, ,,	15 ,,	,,	1	1	$8^{16}/$,,	,,
1 ,, ,, ,,	14½ ,,	,,	1	1	$7^{13}/$,,	,,
1 ,, ,, ,,	14 ,,	,,	1	1	$6^{10}/$,,	,,
1 ,, ,, ,,	13½ ,,	,,	1	1	$5\ ^{7}/$,,	,,
1 ,, ,, ,,	13 ,,	,,	1	1	$4\ ^{4}/$,,	,,
1 ,, ,, ,,	12½ ,,	,,	1	1	$3\ ^{1}/$,,	,,
1 ,, ,, ,,	12 ,,	,,	1	1	$1^{35}/$,,	,,
1 ,, ,, ,,	11½ ,,	,,	1	1	$0^{32}/$,,	,,
1 ,, ,, ,,	11 ,,	,,	1	0	$23^{29}/$,,	,,
1 ,, ,, ,,	10½ ,,	,,	1	0	$22^{26}/$,,	,,
1 ,, ,, ,,	10 ,,	,,	1	0	$21^{23}/$,,	,,
1 ,, ,, ,,	9½ ,,	,,	1	0	$20^{20}/$,,	,,
1 ,, ,, ,,	9 ,,	,,	1	0	$19^{17}/$,,	,,
1 ,, ,, ,,	8½ ,,	,,	1	0	$18^{14}/$,,	,,
1 ,, ,, ,,	8 ,,	,,	1	0	$17^{11}/$,,	,,
1 ,, ,, ,,	7½ ,,	,,	1	0	$16\ ^{8}/$,,	,,
1 ,, ,, ,,	7 ,,	,,	1	0	$15\ ^{5}/$,,	,,
1 ,, ,, ,,	6½ ,,	,,	1	0	$14\ ^{2}/$,,	,,
1 ,, ,, ,,	6 ,,	,,	1	0	$12^{36}/$,,	,,
1 ,, ,, ,,	5½ ,,	,,	1	0	$11^{33}/$,,	,,
1 ,, ,, ,,	5 ,,	,,	1	0	$10^{30}/$,,	,,
1 ,, ,, ,,	4½ ,,	,,	1	0	$9^{27}/$,,	,,
1 ,, ,, ,,	4 ,,	,,	1	0	$8^{24}/$,,	,,
1 ,, ,, ,,	3½ ,,	,,	1	0	$7^{21}/$,,	,,
1 ,, ,, ,,	3 ,,	,,	1	0	$6^{18}/$,,	,,
1 ,, ,, ,,	2½ ,,	,,	1	0	$5^{15}/$,,	,,
1 ,, ,, ,,	2 ,,	,,	1	0	$4^{12}/$,,	,,
1 ,, ,, ,,	1½ ,,	,,	1	0	$3\ ^{9}/$,,	,,
1 ,, ,, ,,	1 ,,	,,	1	0	$2\ ^{6}/$,,	,,
1 ,, ,, ,,	½ ,,	,,	1	0	$1\ ^{3}/$,,	,,

In order to arrive at the final result of Standarding the Bullion under operation, multiply the difference of an ounce in the reported Bullion to the quantity of Standard Silver contained therein by the number of ounces of the Bullion to be Standarded, and add the obtained product in Copper as Alloy.

For surplus dwts. in the Bullion divide the difference in an ounce by 20, and multiply the result by the number of surplus dwts.

EXAMPLE:

What quantity of Alloy is required for Standarding 148 oz. of Silver, reported Better 12 dwts?

Difference of Standard Silver in an ounce
reported Better 12 dwts. .. = 1 dwt. $1\frac{35}{37}$ grs.
For difference of Standard Silver in 148 ozs.
reported Better 12 dwts. .. multiply by 148

Answer 8 ozs.

Table for Standarding Silver of INFERIOR *Fineness, or reported* WORSE.

RULE:—The difference of the gross weight to the quantity of Standard in the Bullion is the *excess of Alloy*, which is neutralised by adding Fine Silver in the following proportion to bring the mass to Standard.

To 1 oz. of Alloy in excess add	12 ozs.	6 dwts.	16 grs.	=12·333 oz. Fine Sil.
,, 1 dwt. ,, ,,	—	12 ,,	8 ,,	= 0·617 ,, ,,
,, 1 grain ,, ,,	—	—	12⅓ ,,	= 0·025 ,, ,,
,, ½ ,, ,, ,,	—	—	6 ,,	= 0·012 ,, ,,

			STANDARD.		EXCESS OF ALLOY.	
			dwts.	grs.	dwts.	grs.
1 oz. of Silver reported *Worse*	½ dwt.	contains	19	$22^{34}/_{37}$	0	$1\ ^{3}/_{37}$
1 ,, ,, ,,	1 ,,	,,	19	$21^{31}/$,,	0	$2\ ^{6}/$,,
1 ,, ,, ,,	1½ ,,	,,	19	$20^{28}/$,,	0	$3\ ^{9}/$,,
1 ,, ,, ,,	2 ,,	,,	19	$19^{25}/$,,	0	$4^{12}/$,,
1 ,, ,, ,,	2½ ,,	,,	19	$18^{22}/$,,	0	$5^{15}/$,,
1 ,, ,, ,,	3 ,,	,,	19	$17^{19}/$,,	0	$6^{18}/$,,
1 ,, ,, ,,	3½ ,,	,,	19	$16^{16}/$,,	0	$7^{21}/$,,
1 ,, ,, ,,	4 ,,	,,	19	$15^{13}/$,,	0	$8^{21}/$,,
1 ,, ,, ,,	4½ ,,	,,	19	$14^{10}/$,,	0	$9^{27}/$,,
1 ,, ,, ,,	5 ,,	,,	19	$13\ ^{7}/$,,	0	$10^{30}/$,,
1 ,, ,, ,,	5½ ,,	,,	19	$12\ ^{4}/$,,	0	$11^{33}/$,,
1 ,, ,, ,,	6 ,,	,,	19	$11\ ^{1}/$,,	0	$12^{36}/$,,
1 ,, ,, ,,	6½ ,,	,,	19	$9^{35}/$,,	0	$14\ ^{2}/$,,
1 ,, ,, ,,	7 ,,	,,	19	$8^{32}/$,,	0	$15\ ^{5}/$,,
1 ,, ,, ,,	7½ ,,	,,	19	$7^{29}/$,,	0	$16\ ^{8}/$,,
1 ,, ,, ,,	8 ,,	,,	19	$6^{26}/$,,	0	$17^{11}/$,,
1 ,, ,, ,,	8½ ,,	,,	19	$5^{23}/$,,	0	$18^{14}/$,,
1 ,, ,, ,,	9 ,,	,,	19	$4^{20}/$,,	0	$19^{17}/$,,
1 ,, ,, ,,	9½ ,,	,,	19	$3^{17}/$,,	0	$20^{20}/$,,
1 ,, ,, ,,	10 ,,	,,	19	$2^{14}/$,,	0	$21^{23}/$,,
1 ,, ,, ,,	10½ ,,	,,	19	$1^{11}/$,,	0	$22^{26}/$,,
1 ,, ,, ,,	11 ,,	,,	19	$0\ ^{8}/$,,	0	$23^{29}/$,,
1 ,, ,, ,,	11½ ,,	,,	18	$23\ ^{5}/$,,	1	$0^{32}/$,,
1 ,, ,, ,,	12 ,,	,,	18	$22\ ^{2}/$,,	1	$1^{35}/$,,
1 ,, ,, ,,	12½ ,,	,,	18	$20^{36}/$,,	1	$3\ ^{1}/$,,
1 ,, ,, ,,	13 ,,	,,	18	$19^{33}/$,,	1	$4\ ^{4}/$,,
1 ,, ,, ,,	13½ ,,	,,	18	$18^{30}/$,,	1	$5\ ^{7}/$,,
1 ,, ,, ,,	14 ,,	,,	18	$17^{27}/$,,	1	$6^{10}/$,,
1 ,, ,, ,,	14½ ,,	,,	18	$16^{24}/$,,	1	$7^{13}/$,,
1 ,, ,, ,,	15 ,,	,,	18	$15^{21}/$,,	1	$8^{16}/$,,
1 ,, ,, ,,	15½ ,,	,,	18	$14^{18}/$,,	1	$9^{19}/$,,
1 ,, ,, ,,	16 ,,	,,	18	$13^{15}/$,,	1	$10^{22}/$,,
1 ,, ,, ,,	16½ ,,	,,	18	$12^{12}/$,,	1	$11^{25}/$,,
1 ,, ,, ,,	17 ,,	,,	18	$11\ ^{9}/$,,	1	$12^{28}/$,,
1 ,, ,, ,,	17½ ,,	,,	18	$10\ ^{6}/$,,	1	$13^{31}/$,,
1 ,, ,, ,,	18 ,,	,,	18	$9\ ^{3}/$,,	1	$14^{34}/$,,
1 ,, ,, ,,	18½ ,,	,,	18	8	1	16
1 ,, ,, ,,	19 ,,	,,	18	$6^{34}/$,,	1	$17\ ^{3}/$,,
1 ,, ,, ,,	19½ ,,	,,	18	$5^{31}/$,,	1	$18\ ^{6}/$,,
1 ,, ,, ,,	1oz.— ,,	,,	18	$4^{28}/$,,	1	$19\ ^{9}/$,,
1 ,, ,, ,,	2 ,, — ,,	,,	16	$9^{19}/$,,	3	$14^{16}/$,,
1 ,, ,, ,,	3 ,, — ,,	,,	14	$14^{10}/$,,	5	$9^{27}/$,,
1 ,, ,, ,,	4 ,, — ,,	,,	12	$9\ ^{1}/$,,	7	$14^{36}/$,,
1 ,, ,, ,,	5 ,, — ,,	,,	10	$23^{29}/$,,	9	$0\ ^{8}/$,,
1 ,, ,, ,,	6 ,, — ,,	,,	9	$4^{20}/$,,	10	$19^{17}/$,,
1 ,, ,, ,,	7 ,, — ,,	,,	7	$9^{11}/$,,	12	$14^{26}/$,,
1 ,, ,, ,,	8 ,, — ,,	,,	5	$14\ ^{2}/$,,	14	$9^{35}/$,,
1 ,, ,, ,,	9 ,, — ,,	,,	3	$18^{30}/$,,	16	$5\ ^{7}/$,,

Silver of lower report, as *Worse* 9 oz., will hardly ever occur for the purpose of Standarding; it is therefore needless to extend the table beyond.

In order to arrive at the final result of Standarding the Bullion under operation, multiply the excess of alloy in an ounce of the report by the number of ounces in the gross weight, and add Fine Silver according to proportions given at the head of the foregoing table. For surplus dwts. divide the excess of alloy in an ounce by 20, and multiply by the number of surplus dwts.

EXAMPLE:

What quantity of Fine Silver is required for Standarding 148 ozs. of Silver, reported Worse 12 dwts?

1 oz. reported Worse 12 dwt. contains 1 dwt. $1\frac{35}{37}$ gr. excess Alloy.
For 148 oz. ,, ,, ,, multiply by 148
8 ounces. ,,
1 oz. excess of Alloy requires 12 ozs. 6 dwts. 16 grs. Fine Sil.
For 8 oz. ,, multiply by 8
Answer 98 ,, 13 ,, 8 ,, =98·667 oz. ,,

(To be continued).

The Nugget Swindle.

Heinrich Kirchner and Fritz Hundheim were indicted for having obtained from Mr. Robinson, a pawnbroker, of Mortimer Street, on the 7th July, 1882, £4; on the 30th of June from Mr. Robert Attenborough, £2 10s.; and on the 3rd of July of Miss Fleming, £3 10s. Hundheim was also indicted for obtaining £3 10s. from Mr. Gill, of Hampstead Road, on the 12th July, and £3 10s. from Mr. J. E. Thomson, of Drummond Street, on the 1st July. The prisoners were also indicted for conspiring together to defraud Pawnbrokers.

Mr. Gill, instructed by Mr. John Attenborough, appeared for the prosecution. The prisoners pleaded "Not Guilty," and defended themselves. Kirchner being unable to speak English, the evidence was translated to him by Mr. Albert.

Mr. Gill informed the Jury that the prisoners were charged with obtaining several sums of money from pawnbrokers by pledging with them pieces of metal as being gold, whereas, in reality, they were only brass plated with gold. The metal was represented and appeared to be composed of gold melted into the bottom of a crucible, and the prisoners said that they were working jewellers and that the gold belonged to them.

Mr. Saunders, assistant to Mr. Robinson, of 26, Mortimer Street, proved that on the evening of the 7th July both prisoners came to Mr. Robinson's shop and offered in pledge a piece of metal coated with gold. They asked for a loan of £4. In answer to witness the prisoner Hundheim stated that it was 16-carat gold all through. On the faith of these representations witness advanced £4 upon it. He tested it with acid, and found that it stood the test as being about 16-carat gold. There was a conversation between the two prisoners in German, but witness did not understand it. Witness had since had the piece of metal cut, and found that it was merely a lump of brass coated with gold, and worth about 12s.

Mr. William Edgerton, assistant to Mr. Robert Attenborough, proved that the prisoners had obtained £3 10s. from him by similar false pretences.

M. Goodfellow, manager to Miss Fleming, No. 1, John Street, Golden Square, stated that on the 3rd July, both prisoners called at the shop and asked for a loan of £4 10s. on a piece of metal purporting to be gold. Hundheim said it was solid 16-carat gold, and that it belonged to "Cleman," pointing to the other prisoner, who Hundheim said was a jeweller, and had just come from Germany, and wanted the money to clear his boxes. Witness advanced £3 10s. upon it, and made out a special contract note, which was signed by the prisoner Kirchner, in the name of "Albert Kleman."

Mr. Charles Wright, assistant to Mr. G. E. Gill, of 15, Hampstead Road, proved that the prisoner Hundheim did, on the 12th July, obtain £3 10s. from him by representing that one of these pieces of gold was 16-carat solid gold.

Mr. J. E. Thomson, of 155, Drummond Street, pawnbroker, stated that on the 15th July, the prisoner Hundheim offered to him in pledge a gold watch and chain, and also a piece of metal purporting to be gold, upon which the prisoner asked for a loan of £7. He told Mr. Thomson all these things were his own property, and that he was in the jewellery trade, and that the nugget was 16-carat gold. The watch and chain were really genuine and worth about £4. Witness agreed to lend the prisoner Hundheim £7 upon them, and instructed an assistant to write one ticket for all the things. The prisoner objected to having only one ticket and asked to have two tickets, one for the watch and chain and the other for the nugget. Witness objected to this, but as the prisoner insisted upon it witness gave way. The watch and chain were redeemed on the afternoon of the same day.

Mr. James Moore, assistant to Messrs. Richardson & Son, Upper George Street, proved that on the 19th July both prisoners came to Messrs. Richardson's shop. Hundheim asked for a loan of £7 on the watch and chain (this being the same one which had already been redeemed from Mr. Thomson), and a piece of metal purporting to be gold. Hundheim in answer to witness said that the nugget was 16-carat gold, worth about £6, and that his friend, pointing to the other prisoner, was a working jeweller, and that the gold belonged to him. Witness asked Hundheim if he would allow him to try it, and the prisoner said "Yes." Witness then asked if he could cut it, to which Hundheim replied "Oh, no; if you don't like to take it in give it me back." Witness's suspicions were then aroused, and he cut the nugget deeply at the edge and found that it was only plated. He then called in a constable and gave the prisoners into custody.

Sergeant George Brunsden, D 20, stated that he arrested the prisoners at Messrs. Richardson's shop, and charged them first with the unlawful possession of the goods. Hundheim said to him that the goods belonged to prisoner Kirchner, who was a jeweller, and had just come from Germany, and he wanted some money to redeem his boxes, which were at the railway station. At the station the prisoners gave seven different addresses, only two of which were correct. Witness found that all the addresses which had been given to the pawnbrokers were incorrect. Kirchner said to witness that he had got the watch and chain out of pawn at Munich, and that he obtained the nugget of a jeweller at Cologne. On the 22nd July, when the prisoners were charged with fraud, Hundheim then said he got the nuggets from a man in Covent Garden, and received 5s. for each one he pledged. Witness had searched Kirchner's lodgings and found there the usual tools of a working jeweller, including a blow pipe and charcoal.

The prisoners addressed the jury in their defence, Kirchner asserting that he had taken part in the pledging of the nuggets to oblige Hundheim, and that he was entirely ignorant that they were not solid gold. Hundheim made a long rambling speech, the gist of which was that the same man in Covent Garden, whom he had known for ten years, had induced him to pledge the nuggets, giving him a few shillings for each one he pledged. He did not know that they were not gold throughout.

The judge having summed up, the jury without hesitation found the prisoners guilty. It was then stated that the prisoner Kirchner was wanted by the police in Germany, and that a few months since Hundheim was tried at the Middlesex Sessions with another man for stealing precious stones. The other man was convicted, but Hundheim escaped.

The Judge sentenced each of the prisoners to twelve months' imprisonment with hard labour, and ordered the watch and chain and the pieces of metal found upon the prisoners to be applied towards tho expenses of the prosecution.

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A petition for liquidation by arrangement or composition with creditors has been filed in the Coventry County Court on behalf of Lewis Joel and Gustave Deal, trading as Joel, Son, and Deal, of Coventry, Birmingham, Manchester, and Huddersfield, watchmakers, jewellers, and factors. The liabilities are estimated at over £30,000, and the assets are not yet ascertained. The petition was filed on the debtor's behalf by Mr. Charles B. Hodgson, solicitor, of Waterloo Street, Birmingham, and Mr. Spencer Dominey, public accountant, of Temple Street, Birmingham, was appointed receiver and manager of the estate. It is understood that the assets are considerable, and that a composition will be offered to the creditors.

Birmingham Jewellers and the Stolen Goods Bill.

On Wednesday, the 2nd ult., a meeting of the refiners and manufacturing jewellers of Birmingham was held at the Birmingham Assay Office, Newhall Street, to take into consideration "The Stolen Goods Bill," which is now before the House of Commons.

Mr. C. Harrold presided, and amongst those present were Messrs. J. Thomason, H. Griffiths, J. Joseph, Wilson, Tonks, Johnstone, J. L. Allday; F. Derry, Whitehouse, B. H. Joseph, &c.

The Chairman said that a letter had been written to Messrs. Johnson, Matthey, and Co., London, and in reply they stated that they had communicated with several members of the House of Commons concerning the bill, and also with the Lord Chancellor and Dr. Lyon Playfair, suggesting the advisability of the bill being referred to a Parliamentary Committee, in order that the refiners might give evidence as to the probable working of many of its clauses. They had received a letter from Dr. Lyon Playfair, who advised them to write to the President of the Board of Trade, stating their objections to the bill. They had reason to believe, however, that the bill would not be passed through Parliament during the present session, so that there would be every opportunity to meet and discuss the future course to be pursued before the next meeting of Parliament.

The Chairman said that when he first heard of this bill he was under the impression the Government were trying to push it through Parliament during the present month, as it was proposed to make it law on the 1st September. Under those circumstances he thought it right a meeting in connection with the trade should be called to consider the provisions of the bill. Although it more or less affected the refiners primarily, still the jewellers and silversmiths were under the denomination of refiners. Under this bill they could not buy old material, such as old jewellery, except under certain restrictions. Section 1 of clause 6 provided that any person who bought any gold, silver, or other precious metal, being either old scrap, broken, or defaced metal, should not melt or alter the form of the same until the expiration of not less than seven days after he bought it; and every person who carried on the business of dealing in, or buying, or melting such articles must keep a book containing the particulars with respect to those articles, which book must be submitted for examination on application by a constable authorised to make enquiries respecting stolen gold, silver, or precious metals. It appeared to him (the Chairman) that any person who bought any old gold and silver would have to put it aside for a week before he could melt it. If he could not melt it, he would not be able to pay for it, and the jeweller, probably a silversmith, would have to wait for his money for a week. That meant that a large amount of capital would be required, and in the cases of small manufacturers they were unable to wait a week.

Mr. H. Griffiths thought the clause was a very good one. The object was to prevent robbery, and not to interfere with any legitimate trade, either carried on by manufacturers or by refiners. If the bill were passed it would not affect any respectable refiner or manufacturer, but it would try to stop robberies. If refiners, and all who received old gold and silver metal, were compelled to keep it seven days, it would be one of the best things that could possibly be done to prevent the small and great robberies that were constantly taking place. The manufacturers knew that bits of metal were stolen and quickly melted, and that the refiner who bought it would pay for it the next day. So long as that practice was carried on, so long would a vast number of small and great robberies continue; therefore anything that could be done to put a stop to such robberies would receive his support.

Mr. J. Joseph urged that the bill aimed at the prevention of an enormous number of robberies. The clause referred to would not touch the respectable refiner, manufacturer, or shopkeeper (hear, hear), but it would protect all of them. The chairman had alluded to the amount of capital that would be locked up, but that was a trivial matter indeed in comparison with the benefits that would be derived. In protecting themselves they must not mind putting up with some little inconvenience.

The Chairman and several others pointed out that the bill did not refer to ingots, and therefore the metal might be melted into ingots and then sold.

Mr. Wilson said the refiners and manufacturers would hail with satisfaction any measure that would accomplish the object which no doubt this bill had in view. His objection to the bill was that it absolutely failed to accomplish the desired object, owing to the total ignorance of noble lords as to the manner in which business was carried on in the country. The bill had been carelessly and slovenly drawn, and it would not do what was required, as the metal was invariably melted, assayed, and altered before it was actually bought. There was nothing in the bill to prevent a burglar taking a cab-load of metal to be melted, and then taking the bars to a refiner and selling them.

Mr Tonks concurred in the remarks made by Mr Wilson, and

Mr. Johnstone and Mr. Allday defended the bill.

Mr. F. Derby moved "That a committee be appointed to consider this bill, and to report to a subsequent meeting its defects or excellencies, and make such suggestions as may be necessary to effect the object of the bill; that they also be empowered to communicate with the Board of Trade and the Lord Chancellor, so that all needful action may be taken promptly against the passing of the bill in its present state."

Mr. B. H. Joseph seconded the motion, which was carried unanimously.

The committee was appointed, and the meeting then terminated.

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Messrs. G. and F. E. Wattis, Birmingham.—Our larger shopkeepers in the clock and optical line, when making their periodical purchases of fresh stock, have until very recently been obliged to travel to London, because that was the only place where wholesale houses could supply them with every kind and class of goods they might require, and at really wholesale prices. Of late years, however, several provincial houses have sprung up in competition with the London firms, and to the buyers it is certainly an advantage, as in many cases it meant a long and expensive journey, and time which could be but ill afforded. One of the most enterprising of these firms are Messrs. G. and F. E. Wattis, of Birmingham. Their large and rapidly extending business compelled them to remove from their old place in Vittoria Street to larger and more convenient premises in Lower Temple Street and Stevenson Street, opposite New Street Station, the principal station in Birmingham, and to which the Midland and London and North Western Railways run; the Great Western Railway Station is also within five minutes' walk from Messrs. Watti's establishment, so that they are certainly most favourably situated for travellers from all parts. We had recently an opportunity of going over Messrs. Wattis's show rooms, and, without going into details, we may state that they offer a stock which for design, quality, and price, will favourably compare with our best metropolitan houses; and as Birmingham occupies such a central position in the kingdom, we do not see why a most extensive business should not be done from this establishment.

Standard Time for the World.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—A recent conversation with an American gentleman relative to the report of the American Society of Civil Engineers, published last month in this Journal, has induced me to trouble you with a letter on the subject.

It would appear that the idea is to bring the minutes and seconds into agreement all over the world, the only difference being in the hours, so that the convenience of railway travellers may be consulted. In our own country, the result is attained by ignoring local time altogether, so that to all intents and purposes longitude has no existence; but as the variation is so small it can easily be allowed for, the most extreme westerly station (Penzance) being only 22 minutes 20 seconds slow, while Yarmouth, in the east, is only 7 minutes fast, making less than half an hour in the aggregate. Even this difference has been productive of inconvenience and uncertainty, especially in legal matters, and on the 2nd of August, 1880, an Act was passed, termed "The Definition of Time Act," by which it was enacted that Greenwich mean time should be legal time for Great Britain, and Dublin time (24 minutes 48 seconds slow) for Ireland. Paris time, which is 9 minutes 21 seconds fast, governs the French railways, and St. Petersburgh time, 2 hours 14 minutes 4 seconds fast, that of Russia.

In a large country like America the case is far different; there every state considers itself as good as the others, and in many instances a great deal better, so they are not disposed to be governed by the time of any one locality; besides which, the distances are so much greater. New York time is 4 hours 56 seconds slower than Greenwich, while San Francisco, on the other side of the Continent, is 8 hours 10 minutes slow.

My informant tells me that in one railway station in Boston three distinct times are kept, viz., that of Boston, New York, and Buffalo; and it is beyond the capacity of even Waltham watches to accommodate themselves to them all, although the feat may possibly be reserved for the productions of the predicted National Watch Manufacturing Compy. of London, whose future proceedings are being recorded in your columns.

I was once seriously asked to so regulate a watch for the use of a gentleman travelling eastwards, that it should gain gradually and so save the trouble of daily alteration, because, in point of fact, it is only the time carried by travellers which reveals the error or difference, whichever is the better word.

Jules Verne introduces a character in one of his tales who is greatly enraged on arriving at Suez to find that his watch, an old heirloom, is more than two hours slow, and is informed that he must alter it to agree with the time of each country he passes through. "I alter my watch!" exclaims he; "never!" He is then told that it will no longer agree with the sun. "Then," says he, "so much the worse for the sun; it will be he who has gone wrong."

The advice which Captain Cuttle gave concerning *his* celebrated watch, viz., to put it back half an hour every morning, and about another quarter towards the afternoon, "and it's a watch that'll do you credit," would tend to prove that he was accustomed to travel in the opposite direction, or on *westerly* voyages, about which I have been writing to a contemporary, and which led to the present topic being brought before the notice of your readers.

The sun-dial, after all, is the only horological instrument that denotes true time, and about two years ago I received a letter from a gentleman who believes that the earth is flat, in which he challenged me to prove that it either revolved on its own axis, or moved round the sun, because he said that if it did, the sun-dial would be useless. I declined the controversy, and have heard no more of my correspondent; but the point is really an interesting one.

The fact is, that telegraphs and express trains have fairly got ahead of the natural laws which govern the planet on which we live, and therefore the necessity of an artificial system such as the one now under consideration is very apparent. Watches will not require to have their hands altered between the ranges of the 24 meridians of 900 miles each, and that of itself will be some advantage.

Aug. 24th. JAMES U. POOLE.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

XXXIX.

Iron and Steel Deposits.—Iron may be deposited by the wet way, but is very easily oxidised. It is obtained by decomposing by the battery a perfectly neutral protochloride of iron. This bath is rapidly altered by the air, and is transformed into sesquichloride, which is unsuited for the purpose. The double chlorides of iron and ammonium, obtained by the protracted boiling of a solution of sal ammoniac upon iron filings, produces a very thin deposit of iron, very difficult to oxidize, which is employed for hardening the surface of engraved plates, or of ordinary electrotypes. Double sulphates of iron and ammonia, or of iron and potash, and double chlorides of the same bases, have been successfully used for electro-deposits of iron.

Antimony Deposits.—This has all the brightness of cast iron; its dead lustre is a slate grey, and it may be easily scratch-brushed and polished. It resembles black platinum, and may take its place in many cases. Boil for an hour in a porcelain dish or enamelled cast iron vessel—

Water	$2\frac{1}{5}$ gals.
Carbonate of Soda	70 oz.
Finely powdered Sulphide of Antimony	$17\frac{1}{2}$ oz.

Filter the boiling solution through paper or fine cloth; by cooling, it deposits a reddish-yellow powder of oxysulphide of antimony. Boil this powder again in the same liquor, and the new solution is the antimony bath. It is necessary to use the bath constantly boiling. For the anode, use either a plate of antimony or a platinum wire.

Lead Deposits are obtained by the plumbite of potash or soda, which is prepared by the protracted boiling of $\frac{1}{3}$ oz. of protoxide of lead in $3\frac{1}{2}$ oz. of caustic potash or soda, dissolved in $2\frac{1}{5}$ gals. of distilled water.

Coloured Electro-Chromic Rings.—After the plumbite of soda bath has cooled off, the metallic or metallized article connected with the positive pole is dipped into it; then the platinum wire communicating with the negative pole is gradually introduced into the liquor without touching the article, which is immediately coloured in various shades. Too much intensity in the current will hide all the various tinges under a uniform dark brown coat. When an article is unsatisfactory in its colouration, dip it rapidly into aquafortis to dissolve the oxide of lead and restore the metallic surface to its primitive state. This process may be used for the decoration of stoneware and porcelain previously coated with platinum.

Reduction of Old Baths.—Extraction of gold.—All the liquids which contain gold, except those in which there is a cyanide, are strongly acidulated by sulphuric or hydrochloric acids, unless they are already acid, and then largely diluted with water. Precipitate the precious metal by a solution of sulphate of protoxide of iron, copperas, and, after a few hours' standing, it is ascertained that the liquor does not contain any more gold when a new addition of sulphate of iron does not produce any turbidity. The precipitated gold is in the form of a red or black powder; collect upon a filter, wash and dry in an iron pan with weights equal to its own, of borax, saltpetre, and carbonate of potash. Gradually introduce the powder into a refractory crucible heated to a white heat in a good air furnace. When all is introduced increase the heat and close the furnace, so that all the metal may fall to the bottom of the crucible. After cooling, extract the button of pure gold which remains. If it is desired to dissolve the powdered gold left on the filter in aqua regia, it will be necessary to wash it several times with diluted sulphuric acid, to remove the sulphate of iron with which it is impregnated. This mode of reduction is adapted to an impure chloride of gold, to the baths by dipping with the bicarbonate or pyrophosphate of soda, and also to the ungilding acids; but it is imperfect with baths holding a cyanide, which never completely part with all the gold they contain, by this process. The best manner of treating the latter liquors is to evaporate them to dryness in a cast iron kettle, and calcine the residue to a white heat in a good crucible. A small proportion of borax or saltpetre may be added to aid the fusion, but generally it is unnecessary. The resulting button of gold at the bottom of the crucible is red when saltpetre has been employed, and green with borax, but these differences of colour have nothing to do with the purity of the metal. Gold may be separated from liquors which contain no cyanide by an excess of protochloride of tin, which produces a precipitate easily reduced by heat. Sulphurous acid will also reduce the gold, but in this case the liquor should be heated. Granulated gold is obtained by running the molten metal in a small stream, and from a certain height, into a large quantity of cold water.

Extraction of Silver.—Liquors containing in the form of a simple salt in solution by an acid are easily treated; add to them an excess of common salt, or hydrochloric acid, the silver will be precipitated as chloride of silver.

(To be Continued.)

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Silvering Iron.—Mr. C. Saton, of Vienna, first covers the iron with mercury, and silvers by the galvanic process. By heating to 300° C, the mercury evaporates and the silver layer is fixed. Ironware is first heated with diluted hydrochloric acid, and then dipped in a solution of nitrate of mercury, being at the same time in communication with the zinc pole of an electric battery, a piece of gas carbon or platinum being used as anode for the other pole. The metal is soon covered with a layer of quicksilver, is then taken out and well washed and silvered in a silver solution. To save silver, the ware can be first covered with a layer of tin; one part of cream of tartar is dissolved in eight parts of boiling water, and one or more tin anodes are joined with the carbon pole of a Bunsen element. The zinc pole communicates with a well-cleaned piece of copper, and the battery is made to act till enough tin has deposited on the copper, when this is taken out and the ironware put in its place. The ware thus covered with tin chemically pure is silvered, and is much cheaper than any other silvered metals.

Bronzes.

By C. D. E. Fortnum, F.S.A.

(Continued from page 25.)

But as regards the invention and the modelling of such works, these came, as we believe, not only from the teaching, but, in the majority of instances, were the frequent contribution of foreigners, who may have been among those numerous artistic brothers of the monastery to whom the arts in the church owe so much of their historic renown. Doubtless these would be materially influenced by various surroundings; and the original Byzantine mode of treatment would, to a greater or less extent, be modified, resulting in that peculiarity of representation observable on the early German gates of bronze, in which some learned critics have discerned a native and original romantic element. Looking at them in a German atmosphere, though not with German eyes, we confess we cannot discern other than a modified Byzantine treatment and manipulation, influenced to the extent of a variety by local circumstances and impressions. To this root later works may well be traced, some of which are known to us as "Rhenish byzantine," and "Byzantine romanesque."

At Aix-la-Chapelle we find in the cathedral bronze-work of the Carlovinian period, in which classic ornamentation is apparent. The bronze pine-cone or artichoke may be of the tenth century, but the lion-headed door handles, surrounded by a palmette bordering in classic taste, remind one of the Etruscan manner. These are probably Carlovingian, and free from Byzantine influence, as are some bronze gratings in the interior of the church. At Cologne are doors with classic mouldings, and lions' heads in similar style. At Brunswick is the bronze lion, a Byzantine work of the eleventh century, said to have been brought from Constantinople, but by other authorities ascribed to German artists of of the twelfth. A cast of this is in the South Kensington Museum (No. '73—383). We learn that about the year 990 the Bishop of Verden, in Saxony, gave six brazen columns to the abbey church at Corvey, and other six were subsequently executed by an artist named Gottfried.

It would seem that the Germans were clever in the casting of bronze, an art that is referred to in the work of Theophilus. Accordingly, we find in the churches of many parts of Germany important monuments in this material. We can name here one or two only, referring for more details to the introduction to the large catalogue.

A Hildesheim Bishop Bernward caused a bronze gate to be cast for the cathedral. It was finished in a.d. 1015, and is still the great gate of that church. By German critics it would seem to be considered as a work of native and not of Byzantine production, the rude modelling being rather influenced by a romanesque or debased classic style. A brazen column was also made for the church of St. Michael, in 1022, by the orders of the same Bishop; it now stands in the cathedral, Peatz, and is some 15 feet in height, although wanting the capital and surmounting crucifix. At Hildesheim, also, are the magnificent coronal of the second half of the same century; another is at Aix-la-Chapelle. Copies of the Hildesheim doors, brazen column, corona, and of the Augsburg doors, are in the South Kensington Museum.

Augsburg cathedral has bronze doors cast with subjects in relievo on separate panels, but which are supposed to have been made up from two distinct works; the subjects of the panels are in duplicate.

Following the history of its development in the north and western parts of Germany to the low countries, we find that the twelfth century saw a considerable increase in the amount and in the direction of artistic work, both in bronze and in stone. Flanders, even early in the century, had made a great advance in the production of metal work, and Dinant became the centre of the industry. The churches of Sta. Sophia at Novgorod, and the cathedral at Gnesen have bronze gates; both are believed to be the work of Saxon casters. The plain panelled doors of Mayence Cathedral, with lion's head handles, are of the twelfth century—1135. The tomb of Rudolph of Swabia, in the cathedral of Merseberg, is of the later years of the eleventh, or an early work of the twelfth century. It is a slab representing Rudolph in bas-relief, richly clad in a dress enriched with gems and with engraving. At Halberstadt, is an episcopal slab monument in the Church of Our Lady, and another is in the Cathedral at Magdeburg, in memory of the bishop Frederick I., who died in 1152.

This century was even more distinguished by the production of reliquaries, crucifixes, monstrances, and other church furniture in gilt bronze, as well as in the precious metals; the Rhenish and central towns and artists being, perhaps, the most abundant sources. Many of these have survived to our days and are preserved, some in the sacristies of churches, others in museums and private collections.

There is but little doubt that the incised monumental slabs generally known as "brasses," and which are more numerous in England than elsewhere, had their origin in Northern Germany or Flanders, more probably in the former country. Perhaps the earliest now existing is in the Church of St. Andrew at Verden, to Bishop Tso. von Welpe, 1231. At Hildesheim is one to Bishop Otho, of 1279. In early German examples (fourteenth century) the figure is left in a sort of flat relief by the excision of the surrounding field, the details being finished by engraving, as on that at Brunswick to John de Rintelen, 1376. At a latter period (fifteenth century) the face is sometimes represented in low relief, as in that to bishop Peter at Breslau, 1456. This method would again lead to the modelling of the entire figure in low or full *relievo*, of which there are examples at Bamberg, Marberg, Cracow, &c.

The thirteenth century brought with it a development of the plastic arts hand in hand with architecture, which no preceding period had known since the decline of classic sculpture. This sentiment, inspired by deep religious feeling, created for itself a new expression in the wide acceptance of gothic or pointed architecture. There were, moreover, a purity and grace in the varied productions of the thirteenth century, and an objective and elevated tone, curiously analogous to, although widely divided from, that which prevailed about the period of Pericles; analagous also, but much nearer, to the earlier productions of the *renaissance* in Italy. Architecture, sculpture, and painting (in polychrome), particularly in the employment of coloured glass for windows, went hand in hand as loving sisters and fellow-labourers in the one object—the harmonious completion of buildings and ceremonial ornaments devoted to the glory of God.

While sculpture developed to a remarkable extent in this direction in France, a more independent, homely, and naturalistic feeling, combined with Romanesque treatment, still prevailed for the most part in Germany: producing works frequently rude in conception, although not without occasional grandeur and beauty. The bronze font in Würzburg cathedral is the work of Master Eckard, of Worms, cast about 1279: it is in the Gothic manner, having scenes from the life of Christ in eight divisions, executed with more care than artistic merit. Some admirable reliquaries and other church objects, with figures of the apostles, &c., in copper or bronze gilt, as well as candelabra, ewers, &c., were made during this century; among them are the shrine of the Virgin in the cathedral of Aix-la-Chapelle, others at Tournay, &c.

Hardly so satisfactory, because not so pure, the sculpture of the fourteenth century becomes still more florid in ornament, and although of excellent technical execution is wanting in originality of invention and in the expression of high feeling; a greater tendency also to a naturalistic treatment, gained ground and grew into a conventional mannerism. At Nuremberg some of the most important works of German sculpture were produced in stone during the fourteenth century, enriching the noble churches of that interesting old city. At Augsburg, Cologne, &c., are others. The carved wooden altar *retables*, of this and the next century, are also important. Meanwhile some of the metal work was of great beauty, although the larger works in bronze do not equal the excellence of the stone sculpture of their time in Germany. At Prague is the interesting equestrian statue of St. George, executed in 1373 by Martin and George von Clussenbach by order of the emperor Charles IV. It is a most vigorous and admirable model, conceived with great spirit and displaying much knowledge and observation of nature. Although nearly two-thirds of the size of life, the details are finished with great care, and altogether it is one of the most remarkable works in bronze of the fourteenth century. (A cast is at South Kensington, No. '64.—113.) In Cologne cathedral is the noble bronze tomb of Conrad von Hochstaden, the archbishop, who died in 1261, but the monument was not erected till the following century, probably after 1322. The figure exhibits great dignity and solemn repose.

We have seen how comparatively rare was the use of bronze for monumental sculpture in Germany, and this was also the case in France during the thirteenth and fourteenth centuries. In stone the northern artists had made considerable executive progress, but no higher advance in the creative spirit had become apparent. Meanwhile Italian sculptors had left the rest of the world's art still bound in the architectural fetters of the "Gothic" manner which confined the growing naturalistic spirit of the age. In the north that beautiful architecture still prevailed, and sculpture dared not encourage her longing after greater freedom. In Italy the dormant classic taste gladly welcomed a revival of antique architectonic forms; and sculpture also freed herself from those restrictions which the pointed style, never strictly adopted in its purity but more or less varied under Italian hands, had only lightly imposed. The gothic was an exotic of the north, which, beautifully modified by the Italian soil and clime, became a very lovely but erratic variety, soon to fade away before the revived cultivation of an indigenous manner. There is, nevertheless, a wondrous charm in the delicate propriety, the grace, and earnest truthfulness displayed in some northern sculptures of the gothic period; but at its decline that art shows us the spirit of revolution and unrest, without attaining to a fixedness and dignity of character or beauty of expression. Subsequently, in the latter half of the fifteenth century, a strongly picturesque dramatic rendering of sacred subjects is manifested in the curious carved and coloured wooden altar-pieces, &c., some of which may be referred to at South Kensington (Nos. 5894.—'59, 192.—66, 2418.—'56).

But we cannot here enter upon the interesting and, in England, the little known subject of these remarkable wood carvings and their authors, among which are some works of extraordinary beauty, as also many of exaggerated and offensive action and detail; we allude to them as occupying in German plastic art the place which in Italy was filled by sculpture in marble and in bronze.

(*To be Continued*).

Trade Notes.

As we have already privately informed many of our readers, the annual trial of chronometers at the Royal Observatory, Greenwich, terminated July 29th. Forty-six instruments were entered for competition, and it is with sincere appreciation of his skill and genius that we congratulate Mr. Kullberg on once more heading the list. Messrs. C. Frodsham & Co. occupy the second position; this well-known firm have not competed since 1874. Mr. Keys, who it will be remembered headed the list with an unusually fine chronometer in 1879, is third; and Messrs. James Poole & Co., who stood third and fifth last year, are fourth, showing that Poole's auxiliary is still able to maintain a creditable position among the later inventions or improvements. The fifth place is taken by Mr. Birchall, who has long been known as a skilled practical workman. It will be interesting to know what course the Clockmakers' Company will adopt respecting the prizes they offer; as, according to the conditions, the first prize will not be again awarded to the same competitor.

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Says the American *Boston Journal*—"Within a few days the American Watch Company of this town has completed and forwarded to the head-quarters of the United States Signal Service Bureau at Washington a large, novel, and very finely constructed clock, for the use of the service. The case is made of brass, of sufficient height to allow the swing of a pendulum one metre in length. The case is made perfectly air-tight, and has been constructed in such a manner that the air can be exhausted and the movement run in a vacuum, thus avoiding the variations incident to atmospheric changes. A very ingenious electrical attachment has been affixed to the movement, whereby the clock is wound as it runs, thus overcoming the variations usual when the mainspring is fully wound or partly spent. The manner in which this is accomplished is by alternately breaking and closing an electric circuit, and using the motion thus obtained and the power of the electrical current in re-winding the spring by means of a worm and other mechanism, which is so graduated as to motion, that the winding keeps exact pace with the running. The slightest variation from this is shown on a delicate indicator attached thereto. The train is jewelled and will consequently be but very slightly affected by the friction incident to such a complicated piece of machinery. Another of these is in process of construction, and is intended for use at Wesleyan University, Middletown, Connecticut.

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At the Middlesex Sessions, on the 21st ult., a watchmaker named Robert Marson, sixty-four years of age, was indicted before P. H. Edlin, Esq., Q.C., Assistant-Judge, for stealing a watch and a ring, value £10, the property of Dr. Morgan Williams. He was also charged with receiving the same, well knowing them to have been stolen. The prisoner was in the employ of a jeweller in 1880, but was discharged for some dereliction of duty. The prosecutor, who is a doctor at Hoxton, entrusted him with his watch and chain to repair, not being aware at the time that he had left his employer. A long time afterwards the prisoner passed the prosecutor's shop, when he was given into custody. The prisoner sent one or two letters to him, enclosing the pawn tickets of the property soon after he had received it, in which he alleged that he had been robbed, and would repay him for the loss he had sustained. In the course of the proceedings it transpired that the accused had been two years in the infirmary, and was on his way to the prosecutor's shop when he was given into custody. Notwithstanding that the pawnbrokers who had received the property in pledge were informed that it had been stolen, they had sold it. The jury found the prisoner guilty, but recommended him to mercy on account of his ill-health and the time which had elapsed since the receiving of the property had taken place. In answer to the Court, the constable in the case said he had a sum of £40, which he found upon the prisoner. Mr. Geoghegan, who appeared for the defence, said the prisoner was willing to make recompense to the prosecutor. The Assistant-Judge sentenced Marson to one one month's imprisonment without hard labour, during which time he would have the attention of the surgeon of the prison.

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A daring robbery of jewellery took place at the premises of Mr. F. A. Bowler, 71, Piccadilly. The establishment was closed as usual at five o'clock on a Saturday, and everything then appeared to be perfectly secure. The jewellery had been taken out of the window and placed in a safe at the back of the shop. During Saturday and Sunday nights nothing occurred to arouse the suspicions of the people living in the house; no noise of any description was heard to proceed from the shop, and externally there was nothing to show that a forcible entrance had been made. An assistant found, at eight o'clock on Monday morning, evident signs that the premises had been visited by burglars, for a number of empty jewellery cases was found strewn about the floor, while the safe was unlocked. The premises are so strongly secured at the back that an entrance from behind is almost impossible. It was therefore apparent that the robbers had entered from the front, and further investigation proved the truth of this supposition, for of the three locks by which the shop door is secured, and which had been left perfectly safe on Saturday, two were found unfastened. Mr. Bowler, who resides at Clapham, was telegraphed for, and on arriving at his establishment examined the safe. He ascertained that the whole of the jewellery in the safe had been taken, including 70 gold and pearl bracelets, 120 scarf pins, some of them set with precious stones (pearls and corals principally), 30 gold brooches, about the same number of earrings, 30 complete sets of links and studs, and 40 sets of studs. The value of the property thus abstracted is estimated at from £1,100 to £1,200. Fortunately the thieves were unable to open two drawers in the safe, wherein were deposited a large quantity of diamonds and other extremely valuable property, worth some thousands of pounds.

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The last novelty in locomotion comes from Philadelphia. The principle on which it is based is that of "confined resistance," as illustrated by the ordinary watch-spring; and it has, it is said, been successfully applied to tram-cars. A powerful spring is wound up by steam power (the only purpose for which that agent is employed) before the car is despatched. When fully wound this spring retains sufficient energy to propel the car, with its full complement of passengers, for a distance of five miles, in a space of time varying from thirty-two to forty minutes. Along the line the necessary stations are constructed, with winding-up engines; just as for the compressed-air engines there are prepared periodical "pumping stations." For this new motive power is claimed immunity from accident, economy in horse-flesh and stabling, and freedom from smoke, smell, or noise. The last-named advantages we do not doubt; but with regard to the first, it is well known that the best tempered springs sometimes give way, and the sudden breaking of a confined spring, capable of propelling a weight of several tons for five miles, might not impossibly be accompanied with some danger.

A daring outrage was recently committed in Birmingham. A well-dressed man, describing himself as a farmer, and named Northbrook, entered the shop of Mr. Albert Pearsall, jeweller, in High Street, and pretended to treat for the purchase of some trinkets. While the assistant's attention was diverted from him, Northbrook struck him a violent blow with a large stone tied in the corner of a pocket handkerchief, and attempted to escape with several valuable gold watches. The assistant leaped the counter, blood streaming from his head, and grappled with the thief. The latter, however, being a powerful man, forced him through a plate-glass case in the window, and he then ran into the arms of a constable within ten yards of the shop. The attempted robbery was the more daring from the fact that several house painters were engaged outside the premises at the time.—On the 8th ult. the prisoner was charged with violently assaulting Edwin Luckhurst, the assistant, and attempting to steal four gold watches. He was committed for trial at the Sessions.

Thomas Smith, a watchmaker, who has been many years in business in Lincoln, was recently brought up on remand on a charge of misappropriating articles entrusted to him to repair. Over twenty watches, some of them gold and of considerable value, which have been pledged by defendant, have been identified. Evidence was taken in two cases only, and Smith was then committed for trial at the Quarter Sessions.

Mr. J. B. Yabsley, jeweller, of 72, Ludgate Hill, has been entrusted with the work of designing and manufacturing the Sheriff's chain and badge, which the inhabitants of the Ward of Farringdon Without have decided to present to their newly-elected Alderman (who enters upon his year of office in the Shrievalty this month), in recognition of his long public services, and the manner in which he conducted the recent Aldermanic contest. Both design and workmanship are excellent; probably the chain is one of the handsomest of its kind which has ever been made. The collar, which is thirty-eight inches long, is composed of thirty-two links, sixteen of which are pointed oval shields, with handsome scroll borders, and fleur-de-lis ornamental centres; the other sixteen links are of oblong shape, with Gothic ends, and raised bands across the centre. These are placed alternately, and connected by stout solid oval rings. The central shield bears the monagram "P de K." pierced in gold, and the whole joins a massive and elaborate collar. The badge itself is of elliptic shape, and contains the Arms of the City of London enamelled on a shield, with handsomely carved supporters in bold relief, and a flowing ribbon bearing the motto in blue enamel, "Domine Dirige Nos." These occupy the central part of the badge, whilst above are the Arms, Crest, and Motto of the Sheriff, and beneath those of the Spectacle Makers' Company, of which De Keyser is a member. The whole of the Coats of Arms are beautifully enamelled on separate shields with raised flowing ribbons, bearing their respective mottoes, and are in bold relief, having a background of purple enamel. The border of the badge is studded with fine brilliants, completely encircling the Coats of Arms, and forms a very noticeable feature. The outer border is formed of massive gold scrolls, intersected by the sword and mace, which are also ornamented with the same precious stones. The whole work is of 18-carat gold, and weighs nearly thirty ounces.

* * *

A List of Watches, Watch Movements, Clocks, &c.

The Property of the Worshipful Clockmakers' Company, and Deposited in the Guildhall, London.

(*Continued from page* 26.)

Markham, Markwick, London.

145. Vertical Movement, has a rolling verge, the cut of the balance-wheel reversed, 6826, with enamel dial.

Presented by B. L. Vulliamy, 1816.

146. Vertical Movement, No. 6723. Chiefly remarkable for its elaborate and highly-finished pillars.

Presented by Messrs. F. B. Adams & Sons, 1848.

Martinot, M., à Avignon.

147. Thick French Metal Watch, very large balance, which, when in motion, has the appearance of a pendulum; curiously chased gilt and enamel dial, winds up through the centre, outer case black skin.

Massey, Nicholas, London.

Made Free of the Company, 1693.

148. Imperfect Vertical Movement, curious for having an index on the top of the cock.

Masterson, Rt., at the Exchange, fecit.

Made a Free Brother, 1683.

149. Oval Watch, in a silver hunting cockle-shell case, plain silver dial, hour hand only, catgut. A very curious specimen.

Miscellaneous.

150. Photographs of Clock Watch.

These three photographs represent three different views of a Chronometer Clock Watch, made for W. A. Tyssen Amhurst, Esq., by W. Payne & Co., 163, New Bond Street, London. It strikes the hours and quarters like a clock; when set, will strike the hours after each quarter; when the repeating piece is used, it will, in addition to the hours and quarters, repeat the minutes; it marks on the dial plate the days of the month and the days of the week, and also shows the age of the moon. The seconds hand is a double one, and, in taking observations, by pressing a pin at the side of the case, one hand stops while the other moves on, indicating the number of seconds elapsing between the two events.

Presented by Wm. Wing, Master of the Company in 1873.

151. Ezekiel's Wheel.

Made by George Stockwell, of Sheerness, 1823.

"The appearance of the wheels and their work was like unto the colour of a beryl: And they four had one likeness: And their appearance and their work was as it were a wheel in the middle of a wheel. When they went, they went upon their four sides: and they turned not when they went. As for their rings, they were so high that they were dreadful; and their rings were full of eyes round about them four."—*Ezekiel* i., 16, 17, 18.

Moore, Peter, London.

152. Plain Vertical Movement, with square pillars, No. 10459.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Mudge, Thomas, London.

Apprenticed to George Graham, May 4, 1730; admitted and sworn a Free Clockmaker, January 15, 1738.

153. Very curious and highly-finished Movement, with enamel dial, Remontoir escapement, having an early attempt at compensation applied to the curb. No. 260. Sold August 22, 1755, and made for the king of Spain. It afterwards belonged to a Mr. Langdon.

Presented by J. Grant, 1850.

154. Full Plate, centre seconds (movement only), London, No. 260. Dial enamelled on gold.

This is a centre seconds Watch of a very complicated character, the seconds motion work being so arranged that it can be entirely detached from the escapement, which is a vertical one, with a solid verge. The balance is controlled by two flat spiral springs, one within the other, one only being acted upon by the index, the other being in connection with a spiral compensation coil. There is in connection with this movement a very elaborate amount of mechanism, the object of which is not immediately apparent, but is well worthy the attention of the scientific enquirer.

Presented by J. Grant, 1850.

155. A very elaborate piece of work as a bridge or balance cock, the hole for pivot being formed by four friction-rollers, with diamond end bearing. Regulator with micrometer screw, and other fine adjustments for curb-pins which apparently have acted upon a straight piece of the balance spring. Taken from a vertical remontoir time-piece by Thomas Mudge.

Presented by Charles Frodsham & Co., 1875.

Mudge, Thomas, and Dutton, William.

156. Gold Duplex Repeater, with enamel dial, in a pair of cases, old standard, No. 1432. A fine specimen, in good preservation.

Presented by C. Frodsham, January 11, 1869.
M. Z.

157. Silver-gilt Oval Watch, with silver band and dial, showing the moon's age, the days of the month, and the days of the week.

Nelson, James, Londini.

Apprenticed to Oswald Durant, April 9, 1638; made Free of the Company, 1645.

158. Astronomical Watch, in silver Oval Case, showing the hours, days, weeks, and months of the year, moon's age, sidereal time, equation, &c. Catgut, before the introduction of chains.

Nerry, John, London.

159. Vertical Movement, with curiously chased pillars, no dial, No. 233.

Presented by Edward Streeter, 1875.

Northcote, Samuel, Plymouth.

160. Vertical Movement, jewelled, with enamel dial and square pillars, No. 599.

Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Ordson, William, London.

161. A Vertical Movement, with square pillars and enamel dial, the hour circle represented by letters constituting the name "James Newman,"* No. 8418.

Presented by Edward Streeter, 1875.

(To be continued).

Queries and Replies.

Can any correspondent give me a good recipe for restoring marble clock cases that have become dull?—F. L.

Would some readers of this Journal kindly offer suggestions for fitting up a watchmaker's and jeweller's window so as to show off goods to the best advantage with a minimum of expense—say from £8 to £10—the length of window being about 11 feet, and usual height (modern)? Also, suggestions as to construction of air-tight sashes for enclosing same, and arrangement of shelves, &c., in shop. Advice at once will be esteemed a favour.—H. H.

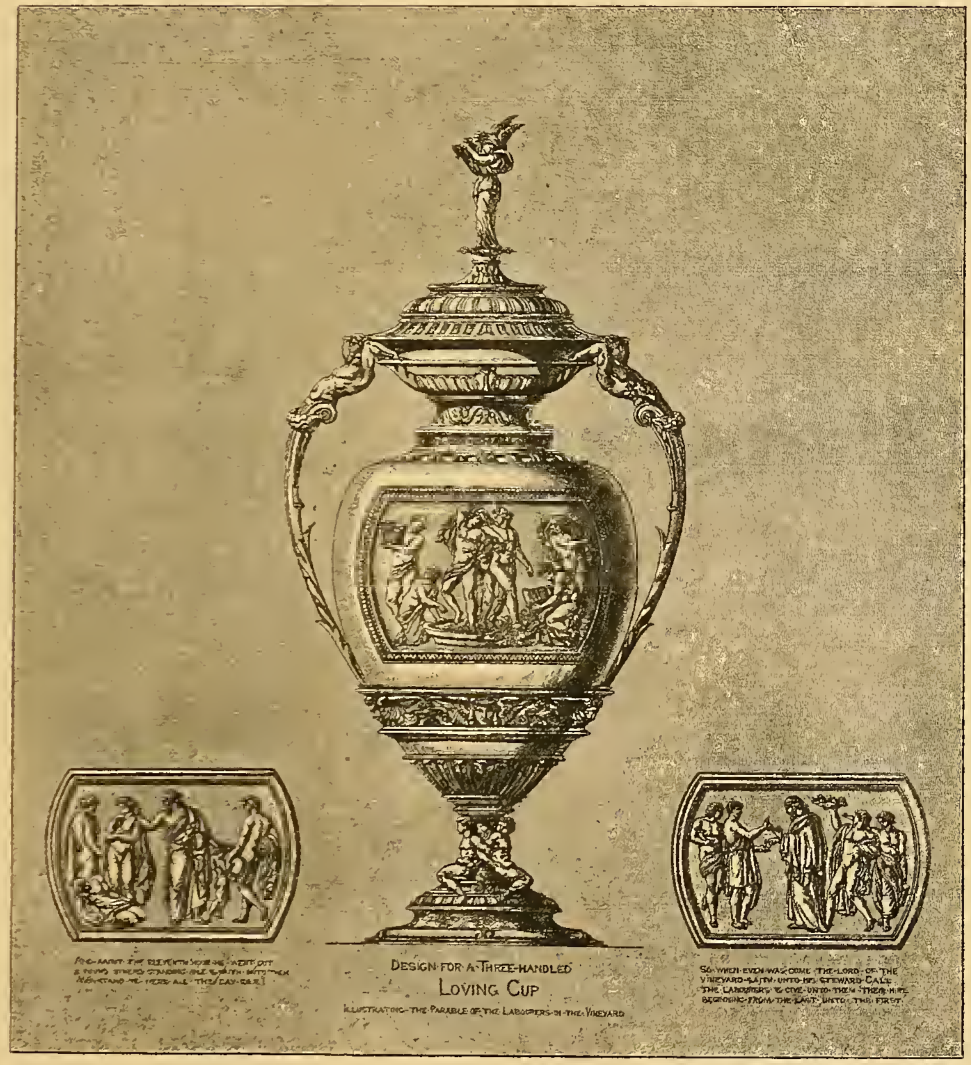
E. W.—I presume E. W. means hard soldering; if so, the articles must be heated to a cherry red, cooled, and immersed in a pickle composed of 1 part of sulphuric acid to 8 of water. Should this not be sufficient, repeat the operation. If, however, soft soldering is meant, it can only be done by the galvanic battery and electro-plating bath.—W. H. H.

To produce a pure white surface on silver articles after soldering, they are first of all boiled in a solution of 1 or 2 parts of sulphuric acid to about 15 or 20 parts of water, to cleanse the article and dissolve the adhering borax. They are then rinsed in clean water, and scratch-brushed or scoured with fine sand; are then dried and annealed in charcoal fire, or before a gas flame by means of the blowpipe. A *freshly-made* solution of the above-named ingredients is then brought to a boiling point in a copper pan, and the article dipped into it for one or two seconds, quickly removed, and rinsed in clean water, when a clean white surface is obtained. For very delicate objects, such as watch-dials or fine filigree work, another process is adopted in addition to the above-mentioned manipulation, viz., after the second boiling the article is again scratch-brushed or brushed with fine sand, then covered with a paste of equal parts of saltpetre and charcoal dust mixed with water, again annealed and boiled in a solution of cream of tartar or alum in water; the strength of this solution is immaterial, a little practice will define its purpose.—H. Bush, Hull.

Coloured Metallic Deposits.—To obtain a greenish-blue patina on copper, brass, bronze, and other copper alloys, Mr. C. Puscher gives the following process in *Kunst und Gewerbe*: The objects are first cleaned and then covered, by means of a brush, with a mixture of one part sal-ammoniac and three parts carbonate of ammonia in twenty-four parts cold water. A thicker layer is obtained by substituting for water thick tragacanth gum solution. The patina begins to form a quarter of an hour after the objects have been covered with the mixture, and is perfectly formed in six or eight hours. It is of a beautiful bluish-green colour. By repeating the operation a better colour is obtained and a tougher layer. This is also the case when the operation is repeated with copal lac dissolved in turpentine. A patina on zinc sheet, bronzed iron, gypsum, earthenware, and wood is obtained by adding to the above ammonia mixture black copper reduced by zinc. According to the quantity of copper used, a thicker or thinner layer is obtained. On iron the colour of the layer is yellowish-green, owing to the formation of hydrated oxide of iron. A blue-green colour is obtained by mixing a solution of chloride of zinc with caustic ammonia until the white precipitate formed redissolves. To this solution the necessary quantity of reduced copper is then added. The solution of chloride of zinc is prepared by mixing one part oxide of zinc with 1½ part water, 2¼ parts hydrochloric acid being added. The reduced copper is obtained by dissolving in cold water 3 to 4 per cent. sulphate of copper, and dipping in the solution a few pieces of well-cleaned sheet zinc. After twenty-four hours the copper precipitates in the form of a black powder, which is filtered, well washed, and dried for use.

Supplement to the Watchmaker, Jeweller, and Silversmith, Sept. 5th, 1882.

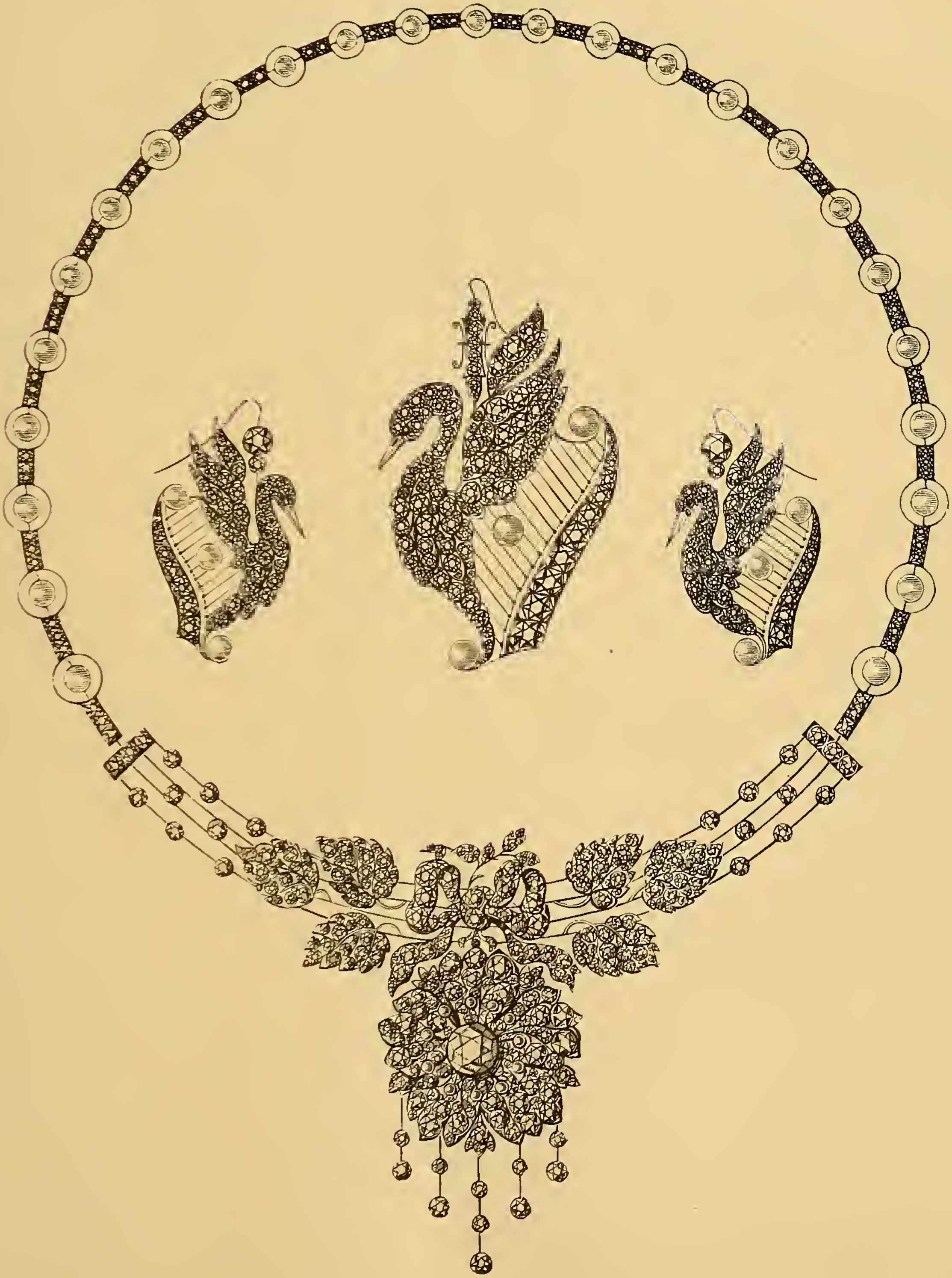
MONTHLY SUPPLEMENT OF DESIGNS.


And about the eleventh hour he went out & found others standing idle & saith unto them Why stand ye here all the day idle?
Design for a Three-handled
Loving Cup
Illustrating the Parable of the Labourers in the Vineyard
So when even was come the lord of the vineyard saith unto his steward Call the labourers & give unto them their hire beginning from the last unto the first.

DESIGNED BY W. H. SINGER, FROME.

Supplement to the Watchmaker, Jeweller, and Silversmith, Oct. 5th, 1882.

MONTHLY SUPPLEMENT OF DESIGNS.



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TWO ILLUSTRATED SUPPLEMENTS:—1. Parisian Gem Work. 2. Antique Rings and Ornaments.

No. 89.—VOL. VIII.] OCTOBER 5, 1882. [Subscription, 5s. per Annum. Post Free.

Greenwich Chronometer Trials, 1882.

THE following are the principal changes of rate of the first six chronometers on the recently-published list issued from the Royal Observatory, with the explanations of their construction as furnished by the makers:—

No. 4066, by V. Kullberg, 105, Liverpool Road, N. (Reversed detent, with short spring).

„ 3593, by C. Frodsham & Co., 377, Strand, W. C. (3 Compensation bar balance).

„ 399, by David Keys, 15, Craven Street, Strand, W.C. (Ordinary balance, with slight alterations. Airy's compensation).

„ 5685, by James Poole & Co., 33, Spencer Street, E.C. (Poole's auxiliary).

„ 1382, by P. Birchall, 12A, Stonefield Street, Islington, N. (Ordinary escapement, with slight alteration to balance).

„ 4070, by V. Kullberg. (Reversed detent, with short spring).

Least weekly sum.	Temperature.	Greatest weekly sum.	Temperature.	Difference between the greatest and least.	Greatest difference between one week and the next.	Extremes of Temperature during these weeks.
s		s		s	s	
−2·4	85° to 98°	+2 7	49° to 54°	5·1	2·0	50° to 107°
−2·9	54° to 58°	+5·6	63° to 72°	8·5	3·7	53° to 60°
−5·2	85° to 107°	+5·7	52° to 60°	10·7	4 6	88° to 70°
−6·8	85° to 107°	+3·3	63° to 72°	10·1	5·5	50° to 107°
−13·1	54° to 58°	+4·2	88° to 97°	8·9	6·5	88° to 70°
+6·3	85° to 107°	+15·7	65° to 71°	9·4	6·5	50° to 107°

In our last article on the subject (Vol. VII. p. 71), we explained the method of working out the "trial numbers." The mean of the sum of those of the first six chronometers in 1881 had not been smaller since 1876, and the Astronomer Royal wrote of them as follows:—"Notwithstanding the circumstance that the competitive trial of 1881 was more severe than usual, owing to the greater range of temperature, the first six chronometers performed on an average slightly better than those in any year since 1877, and the first chronometer was exceptionally good." That chronometer, by Kullberg had the smallest error between one week and the next, on record, viz., $2^{s}{\cdot}9$, but it has been surpassed by the one heading the list this year, and it seems difficult to believe that the error can ever be reduced on future occasions. Mr. Crisp, in a paper read to the members of the Horological Institute, Dec. 6, 1876, in commenting on the performance of a chronometer of his timing, with Poole's auxiliary to balance, made the following remarks:—"We have now the figure 2·9 before us. The question is, how we can reduce the decimal ·9 and improve the sums of the daily or weekly rates of our chronometers in future years." Mr. Kullberg has got rid of the decimal with his first instrument, and by so doing has made his own labours more arduous in time to come.

We find that, in 1873, when the first six chronometers were of an average excellence which has never been surpassed, the chronometer heading the list was of Mr. Kullberg's manufacture, and the second and sixth bore his own name. In that year the range of temperature was from 35° to 95°; this year, owing to the unusual mildness of the winter (artificial cold not being favoured at the Observatory), the temperature was not lower than 45°, although a range of 62° was obtained by raising the heat to 107°. It is well known that chronometers are more likely to alter their rates after severe trials in heat than in cold, owing to the tendency of the balances to take a "set" inwards, and this year's performance is the more remarkable in consequence, although those which perform equally well in low temperature are likely to be more practically useful.

A further study of the list shows that the improvement has been sustained by the next three groups of chronometers, thus, Lister & Sons, 824, Poole's auxiliary and Airy's compensation, standing 16th, has a slightly smaller error than the year before, when it was 9th. Altogether English chronometer makers have no reason to complain at present of any decadence in their art, although it is to be regretted that more liberality has not been manifested by the Admiralty, who at present have only purchased the first three instruments. Supplementary purchases are, however, frequently made afterwards, and we trust that this year will prove no exception, otherwise the expression "on trial for purchase" is somewhat misleading. We observe that the second chronometer is eight days, being only the fourth of that construction which has been entered for competition since 1871. A plausible reason for the falling off in the demand for such instruments in the mercantile marine has been stated to be that formerly a captain would have to transact a great deal of business on shore relating to the cargo, which would keep him for several days away from the ship, consequently an eight days chronometer was a desideratum. Now, the captain is only a navigator, constantly liable to be harassed by telegraphic instructions from the owners, and is often uncertain of the actual nature of a voyage. These reasons of course do not operate in the Royal Navy, but manufacturers are influenced by them in making up their stocks.

In conclusion, we would say that before these lines have reached the eyes of our readers, the greater part of the 43 unpurchased chronometers are doubtless being re-tested for the coming trial, and we wish their makers every success in the friendly struggle.

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SPECIAL NOTICE.

We regret to have to apologise for the non-appearance in this issue of the continuation of "Zadkiel's" valued contribution, "Our National Watch Factory." Zadkiel is a most energetic man, but, like other mortals, he is subject to the influences of over-work, and he has been compelled to take a well-earned holiday. The next instalment of his paper will appear in the November issue.

The Mechanical Properties of Aluminium.*

By W. H. Barlow, F.R.S.

HAVING had occasion to use aluminium in the construction of instruments adapted for special purposes, and having observed that it possessed a remarkable degree of strength in proportion to its weight, and a large range of elastic action, it appeared to me desirable to ascertain more fully the mechanical properties of this metal.

With this object, a bar of aluminium, three feet long and a quarter of an inch square, was obtained, and different parts of this bar were subjected to test for tension, compression, and transverse strain; and also to ascertain the modulus of elasticity, the elastic range and ductility.

The experiments were carefully carried out for me under the able direction of Professor Kennedy, with his testing machine, at the London University; and the results are given at length in the table appended to this paper.

It will be seen on reference to the results obtained that the weight of a cubic inch is ·0972 lbs., showing a specific gravity of 2688, and that its ultimate tensile strength is about 12 tons per square inch. The range of elasticity is large, the extension at the yielding part being $\frac{1}{200}$ part of its length. The modulus of elasticity is 10,000. The ductility of samples, 2 inches long, was only 2·5 per cent.; but it is probable that the metal could be improved in this respect.

Taking the tensile strength of this metal in relation to its weight, it shows a high mechanical value. Its characteristics in this respect, as compared with those of other well-known metals, are shown in the following summary:—

	Weight of a cubic foot in lbs.	Tensile strength per square inch, in lbs.	Length of a bar which is just capable of bearing its own weight.
			Feet lineal.
Cast-iron	444	16,500	5,351
Bronze	525	36,000	9,893
Wrought-iron	480	50,000	15,000
Steel of 35 tons per inch	490	78,000	23,040
Aluminium	168	26,880	23,040

It thus appears that, taking the strength of aluminium in relation to its weight, it possesses a mechanical value about equal to steel of 35 tons per inch.

Aluminium is, unfortunately, a very expensive metal, and although an increased demand might lead to a considerable reduction in price, yet the process by which it is extracted leaves little hope at present of obtaining it at a rate sufficiently low for general use. But its mechanical properties point to its suitability for those cases where strength, combined with lightness and a great range of elastic action, are required. The elastic range is about three times that of steel, and about five times that of wrought iron.

In the discussion, Sir H. Bessemer said that experiments had been made, and others were in hand, by which it was expected to obtain a new process, which would very greatly reduce the cost of manufacture. He also produced a door-key, made in aluminium, stating that forty of such keys would only weigh 1 lb.

It may be added that Sir William Thompson uses aluminium for the rims of his very excellent compasses for ships.

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* A paper read before the Mechanical Section of the British Association, at Southampton.

The Worthies of Horology.

By C. Stuart Murray.

VI.

BEFORE bidding farewell to Dasypodius, I expressed a hope in my former paper to say something about his famous clock; that hope I am now about to fulfil. I shall also be able to correct an error with respect to dates which troubled me much upon the last occasion. I said that I could not reconcile the dates of 1370 and 1547 with respect to the construction of the second clock at Strasburg. It was a translator's error. The year 1370 refers to the *first* clock, of which Dasypodius wrote a description, whilst 1547 referred to the *second* clock, designed and also described by Dasypodius himself. I mentioned one or two of its characteristics in the September number of this Journal, but there are others which are equally interesting that may now be introduced in the form of an abstract of the whole.

The story of a magistrate having put out the eyes of Josiah Habrecht, the maker of the clock, to prevent him constructing another like it, seems to have arisen in this way. Before Habrecht had finished the mechanism of the clock of Dasypodius, the Archbishop-Elector of Cologne summoned him to his castle of Kaysersworth to construct a clock there. This journey, and the illness of one of Habrecht's sisters, who ultimately became blind, and her name, without the statement that this Habrecht was a sister, spreading around the country, was the spark of genuine fire which gave rise to so much apocryphal smoke to the tale of imagination so industriously circulated. I have already said that the second clock was restored twice—in 1669 and in 1732, and that it finally ceased to move in the tower of Strasburg Cathedral in 1789. It was, however, repaired and removed to one of the chapels, where its curiosities in motion may still be seen.

Among many other things, there was a globe revolving among the stars and constellations, together with the sun and moon, on the ancient system of astronomy, with the earth as their centre. Then there was a calendar of feasts and festivals, and pictures of various kinds; eclipses, too, were shown, whilst the planets had their Pagan godfathers *in propria personæ*, each appearing according to the day of the week belonging to him. There were dials for the quarter-hours and minutes, the hours being shown on an astrolabe. One geni lifted up a sceptre at the stroke of each hour, whilst another turned an hour-glass; and there were the phases of the moon, with statuary depicting man in infancy, manhood, and old age. The quarters were struck by figures upon cymbals; but the most remarkable feature was the action of Death and Christ. When the hour was almost closed, the Christ came forward for an instant, when he retired; upon so doing, Death came forward and tolled upon the bell the number of hours required. The cock previously mentioned then crowed, flapped his wings, and shook his head.

Such was the clock of Dasypodius; but what I have stated here is only the merest index of the description of the clock itself. I understand that the full account, with the requisite illustrations, make up an interesting book in German.

We now come to a man who, as far as the genius of horology goes, may be justly dignified as one of the greatest Horological Worthies of our age. This is Schwilgue—as we would say Newton or Hooke—Schwilgue of Strasburg, the father of Charles Schwilgue, historian of the present great mechanical work in that Cathedral.

The construction of the new clock began on the 24th of June, 1838, and the pendulum had its first motion given to it on Sunday, the 2nd of October, 1842, in the presence of the Scientific Congress of France, which met at Strasburg in that year. As that clock is now not merely a wonder of Germany, as its predecessors were, but a wonder of the world, I feel bound to notice it at greater length than would otherwise be necessary; even with that I can only touch here and there some of the leading features. It is stated to be entirely Schwilgue's invention, with the exception of some statuary ornaments, as no part of the clock of Dasypodius was found serviceable for the present purpose. To preserve the traditions of the instrument and the place, the new mechanism has been made to fit the old chamber, whilst there are many extra astronomical automata which were not known in the days of Dasypodius.

Below the clock is a celestial globe, showing upon a dial-plate sidereal time for the latitude of Strasburg. There are 110 groups of constellations comprising more than 5000 stars. This globe carries circles round with it, indicating astronomical changes, showing the passage of all the stars over the meridian of Strasburg. And marvellously ingenious is that of the precession of the equinoxes in action by the equatorial and equinoxial circles. Of course, no motion can be discerned, from the mere fact that, assuming the clock to be as it is now, it will take nearly 26,000 years before a complete revolution of these circles will have been accomplished, 13,000 years for half a revolution, 6,500 years for a quarter, &c.; so that there is not much likelihood of anyone now living in Strasburg—nor, indeed, anywhere else—being old enough to see that any precession has happened at all! But the "fixings" are there, and in contact with the general machinery of the clock, so that there can be no doubt whatever about its "going."

This is very much to the mind's grasp like the celebrated Whitworth "machine" for measuring the one-millionth part of an inch. That "curio" was a famed attraction in Class X. of the Great Exhibition of 1851, and has formed the subject of much hot and strong discussion since. And well it might; for, if we look upon the line of an inch on a rule divided into tenths, and from that go only to twentieths, we should find it pretty sharp work for the eyes. I will say nothing of hundredths, for although mechanically possible, it would be, as one may say, practically useless. But where can I find language to express the bewilderment of the brain in vainly trying to understand what a millionth of an inch means of the space of that inch. I measured with the machine myself, and although I saw the results before my eyes deduced from the data laid down, I did not feel any clearer in the head upon the *length* of the main question than before. Nor am I alone in the misty atmosphere of the scientific fact, for others have agreed with my conclusion; namely, that the man to thoroughly comprehend how much the millionth of an inch comes to must have no brains at all! Having now, I hope, sufficiently hungered the curiosity of my readers, and as they are constantly dealing with hundredths, and even thousandths of inches in their work from day to day, an explanation of how the millionth is arrived at may be interesting. And more especially so as this machine is the only one of its kind in existence. I saw it under a glass case in the South Kensington Museum some three years ago, and it was amusing to note the number of mechanical-speaking men who looked at it, tossed their heads unbelievingly, and would not have its performance at any price. As I have just said, it is the only one of its kind in existence; such an instrument partaking of the pre-natal characteristics of an elephant, being long in time and costly in labour to produce.

The name of it is "A standard bar measurer." It consists of a metal frame, at each end of which is a micrometer. The machine being in front of the observer "full on," the micrometer to the right hand is a combination of a screw about ten threads to the inch, of a tangent screw and wheel with 400 teeth, and also a circle with 250 divisions. Now then, reader, polish up your third "R," as it is wanted here; thus:—The divisions on the circle indicate $\frac{1}{10}$th of $\frac{1}{400}$th of $\frac{1}{250}$th of an inch, or of 1,000,000th part of that length: $10 \times 400 \times 250 = 1000,000$. The micrometer on the left hand has a screw of ten threads to the inch, and a circle divided into 500 parts, so that one part of the circle corrosponds to the 5000th of an inch. On the upper side of the frame, and extending through its whole length, is placed a half-square groove made of steel, with its angle downwards, and its upper edges horizontal. In this the measure is laid. Between one end of the measure and the point of the right-hand micrometer, a perfectly flat contact-piece of metal is placed, with its sides parallel; the other end of the measure abuts against the left-hand micrometer.

There are two methods of determining when contact takes place, and hence the length of the standard measure:

1. By that which is termed the test of gravitation.
2. By that which is termed the galvanic test.

The test of gravitation is as follows:—The experimenter moves the end of the screw of the right-hand micrometer to where the micrometer itself will show the millionth of an inch. He then carefully raises the contact-piece, and allows it to fall by its own gravity. Again he moves a screw through a second millionth of an inch, and again raises the contact-piece, and so moves on until the millionth is reached, at which the contact-piece is held. That completes the measure. In the galvanic test a small battery composed of zinc, copper, and rain water, but without any acid, is connected with the micrometer, and with a delicate galvanometer by means of covered tubes. The contact is indicated by the deflection of the galvanometer.

This explanatory statement with respect to the millionth part of an inch is about as comprehensible to the eye as the circles showing the procession of the equinoxes in the great Strasburg clock.

Behind the celestial globe is an apartment devoted to the calendar in all its changes of ecclesiastical time, their days, and saints, &c. This calendar provides for leap-year, and the excision of three days in 400 years, in order to keep the calendar right. But the late Sir John Herschel went much farther ahead about the calendar. He proposed that every four-thousandth year should lose its leap day, though it is divisible by 400. He computed that we should then be able to get along for about 28,000 years without the error of a single day! Mercy upon us! As if the ephemeral beings of this world could have any possible interest in years by the thousand.

The dial plate of apparent time has a double set of hour figures, and there are also upon it the rising and setting of the sun; true time; the true diurnal motion of the moon round the earth; the moon's phases, and the eclipses of the sun and moon. The motion of the sun for the long and short days throughout the year must have been a nice problem to work out in connexion with all the other mechanism. The centre of the dial represents all the countries of the northern hemisphere with their meridians, in such a way that the sun can be seen passing over them, and eclipses are also made plain in a similar manner. It is claimed that in this clock it is the first time that a perpetual calendar and an ecclesiastical computation have been mechanically combined, and that Mr. Schwilgue invented it himself.

Immediately above the calendar is an arrangement for showing the days of the week, and the Pagan divinity for each day. Upon Sunday there is Apollo, Monday Diana, Mars on Tuesday, Mercury on Wednesday, Jupiter on Thursday, Venus on Friday, accompanied by Cupid in a chariot drawn by doves. Last of all comes Saturn representing Time, armed with a scythe, and about to devour an infant. As Horace expresses it, *Tempus edax rerum* (Time, the devourer of all things). There is the Gallery of the Lions, so named because of the two wooden figures of those animals guarding the entrance. In the centre of this gallery is the dial-plate that indicates *mean time*, which comes directly from the central mover of the clock. Both solar and sidereal time are provided with separate dials and separate mechanism. In this gallery, on each side of the mean time dial sits a geni. One holds in his hands a sceptre and bell, upon which he strikes the first stroke of each hour-quarter. This is a summons to the four ages of man higher up, one of whom repeats the stroke. The geni on the opposite side turns an hour-glass, filled with red sand, every hour as the last bell of the quarter has been given, just before Death steps out to strike the hour. Above the Lions' Gallery is a planetarium upon the system of Copernicus; namely, that the earth and all the old planets move round the sun, as we have it now. It may not be generally known that Copernicus was a German priest-student of astronomy. The old planets are Mercury, Venus, the Earth, Mars, Jupiter, and Saturn. The motion of the moon round the earth is also shown in her lunar orbit. The four ages of man are represented as allegories for the four seasons of the year. The phases of the moon are shown as she moves along a starry sky, enlarging and diminishing in size as she moves. More allegorical paintings enrich that part, whilst at a short distance are the figures in Roman numerals of the years 1838 and 1842, to mark the dates at which the clock was begun, finished, and set going.

But the great attraction for the sight-seeing multitude is composed of the statuette automata. These are the four ages of human life that are employed in sounding the quarters already mentioned, and Death that strikes the hours. These self-acting figures in their performances are very startling. First, there is a child which at each hour commences a procession, and strikes the first quarter by letting fall what is called a thyrsus upon it. This thyrsus was a straight shaft or wand wreathed with ivy and vine-leaves, and was carried in ancient Greece by the devotees of Bacchus. Its allegorical use in the Strasburg clock does not seem to be very clear, especially when borne by the child; if the man used it, the meaning of it would appear a little plainer, children not being looked upon as worshipping Bacchanals. The child having struck the quarter, he is followed by a youth in the form of a hunter, who strikes the half-hour with an arrow. Then comes a warrior in mail-clad armour, wielding a sword with which he strikes the third quarter and retires. A few seconds before the sixtieth minute is reached, an old man arrives, warmly clothed, but bent with age and leaning upon his crutch. He stops, raises the crutch, and sounds the four quarters for the hour, when he, too, disappears and makes room for his dread successor. Last scene of all, Death stands forth, armed with his scythe, and carrying one of his "cross-bones" in his right hand. With this bone he solemnly strikes the hour and returns to his chamber.

In another apartment open to the public is the figure of Christ upon a pedestal, holding in one hand the banner of redemption, whilst giving his benediction with the other. When Death strikes the last stroke of twelve at noon each day, a procession consisting of the twelve Apostles, each carrying the instrument or symbol by which he is known. Arriving before Christ, they all in turn bow reverentially and pass on; the cock overhead flaps his wings, ruffles his feathers, and crows lustily.

The entire height occupied by the machinery and automata of the clock is slightly over sixty-five feet, divided into storeys and compartments for the various automata. The storeys or compartments can be entered or looked into by the persons in charge of the clock. The main dial to show the hours and five-minute subdivisions is nearly eighteen feet across. It has a hand to indicate the days of the week and planetary signs. Notwithstanding all that has been stated here about this wonder of horology, it is little more than an abstract of a full description. The moving powers of the different parts are set up in cases on the ground floor, but the great central motor is one and the same for the entire train. We are told that this central mover is made with the nicest precision, depends upon a regulator which beats seconds, and which is itself kept to time by a compensating pendulum and a jewelled escapement. The way in which motion is transferred from one part of the clock to another is a marvel of skilful planning. "There does not enter into the construction of the clock a single piece of wood, or any easily-decaying material. Choice has been made of the metals which are most durable, and which thus guarantees the preservation of the work."

This clock—the fruit of immense calculations, of toilsome researches, arduous labours—is not, then, as many persons have thought, a mere restoration; it is an entirely new work, both in invention and execution—a work which marks with equal accuracy, seconds and periods of time exceeding twenty-four thousand years. And an enduring monument of the highest order it is to the name of Schwilgue, its inventor, designer, and constructor.

(*To be Continued*).

Hall-marking.*

By G. E. Gee.

THE question of compulsory hall-marking will, in all probability, receive additional attention now that the vexed question of the duty has been so prominently brought forward. It has been said that the abandonment of the duty would also do away with the hall-marking system, and that the result would be the flooding of the country with wares unworthy of the name of the precious metals. This opinion is, we think, more theoretical than practical, and manifests a great want of that knowledge of the system which is essential to a proper understanding of it. The removal of the duty need in no way whatever interfere with the hall-marking of gold and silver articles.

Hall-marking has been practised for more than 580 years, and was instituted long before the duty was enacted. It dates as far back as the year 1300, whilst the duty has existed from the year 1719; the latter, therefore, was imposed 419 years subsequent to the system of hall-marking. It also continued during the period between 1758 and 1784, at which time the duty was temporarily removed. The buyers of gold and silver wares need not be under the slightest apprehension as regards the abandonment of the hall-mark, beyond the removal of one of the cabalistic characters from the present set of hall-marks, viz., the Queen's head, which now represents the payment of the duty. This argument, then, like a great many others connected with this subject, is an unwarrantable assumption, and based upon an imperfect knowledge of the facts connected with the English hall-marking system. It is true the duty question is closely interwoven with the hall-marking system, as it brings into force the compulsory powers of our laws relating to this matter; but that is the only point where the two can be made a part of the same question.

It is compulsory that all duty-paying articles shall be hall-marked, the one cannot at present be separated from the other, and this is precisely what the trade and its adherents are seeking to reform. We think few people will object to hall-marking pure and simple, but it must be without the payment of duty on wares submitted to that process to be at all satisfactory to our present requirements.

At the present time we have compulsory hall-marking and voluntary hall-marking, and the question is, which of these two the trade and those affected by it will in the future prefer. There is something to be said in favour of both systems when the matter is brought to bear upon special articles. For instance, there is the manufacture of watch cases, which in this country must be hall-marked. Whether this regulation is to be continued in the future requires calm consideration and a practical insight into the business; it is not to be decided off-hand. There is this much to be said in its favour, that compulsory powers to mark tend to keep up the standard quality of the cases themselves, whilst it also prevents unscrupulous people from putting inferior cases to their work, which can have but one tendency, and that is, a lowering eventually of the quality of the movements in point of workmanship as well as superiority of finish, which things are all in all to a watch in so far as its time-keeping properties are concerned.

Another point of some importance to the English watch-case trade is, that the compulsory hall-marking of them shuts out the home market from American manufactures. Whether this is an advantage or not to the English workman is not yet decided by those engaged in it; but this much is an established fact, that it is impossible for the English manufacturer to take a colonial order for watch-cases other than hall-marked ones, on account of the compulsory enactment of our existing law, which will not permit of the work being done in this country without being hall-marked; consequently many orders have to be refused, but whether the English artisans have the best of this arrangement is an open question and one that is certain to come to the front for practical discussion, and that, too, in the immediate future; for it is not always that watch-cases are ordered to be hall-marked, some buyers preferring them otherwise when the quality can be depended upon, and under such circumstances the English case-makers cannot be competitors for the work, in consequence of our system, which necessitates the hall-marking of every case made in England.

The hall-mark on a watch-case is a guarantee of the standard quality to a certain degree, but is not an absolute one. There is so much solder run in under the rims of some of them, and other inferior metal employed in the connecting of them together, that watch-cases actually put into the melting-pot and melted down do not assay at more than from 3s. 10d. to 4s. per ounce, being equivalent to from 16 dwts. 12 grs. to 17 dwts. of fine silver per ounce, instead of 18 dwts. 12 grs., which is the hall-marking standard. Anyone who has had anything to do with the melting and assaying of old watch-cases for remanufacture can bear out these observations. In the United States they have no hall-mark, but this has not prevented their manufacturers from making their mark after a certain fashion all over the world. But the fact is, manufacturers should care more for their reputation than for the trifling gain to be obtained through the selling of an article of inferior quality, which a slight deviation from the standard might bring to them.

There are comparatively few persons outside the jewellery and watch trades that know the hall-marks when they see them. They are so fantastically varied in their character that to most persons they are positively confusing and misleading, especially as many of them are more or less spurious imitations of the genuine marks; these being allowed to be put upon the various manufactures by the makers or other interested persons, and in some cases they have been found to be positively fraudulent.

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* From the "Hall-marking of Jewellery Practically Considered."

Plating Organic Bodies with Metal.

[A Communication by Frank L. James, Ph.D., M.D., to the *Scientific American*.]

The short editorial notice in your last number (p. 17, Vol. XLVII.) of Professor Christiani's method of preserving and plating with metal flowers, leaves, insects, and other organic bodies, suggested the idea that a detailed description of similar processes for attaining the same end might be of interest and service to your readers. The following have been used by me for several years past, and in my hands have proven entirely satisfactory:—

For Silvering without a Battery.—The object to be silvered, after being freed from adherent dust, dirt, &c., is immersed for two or three minutes in a saturated solution of gallic acid in distilled water. It is then dipped in a solution of 20 grains of chrystallised nitrate of silver in 1000 grains of distilled water. This operation is to be repeated two or three times, moving the object alternately from one bath to the other, until it has acquired a silvery appearance. It is now rinsed in distilled water, and laid on clean bibulous paper to dry. In the meantime have prepared two solutions as follows—

Reducing Solution: Grape sugar or honey, 5 parts; quicklime (CaO), 2 parts; tartaric acid, 2 parts; distilled water, 650 parts. Mix, dissolve, and filter.

Silvering Solution: Dissolve 20 parts of crystallized silver nitrate in 650 parts of distilled water. Add strongest water of ammonia, drop by drop, continuously stirring the solution with a glass rod until the brown precipitate is nearly, but not quite, re-dissolved. Filter and put in a glass stoppered bottle.

If more of the reducing solution be made up than is needed for immediate use, it should be kept in a closely stoppered vial, filled to the top, so as to prevent atmospheric action.

Equal parts of these solutions are mixed together in a gutta percha or japanned dish, and after thorough stirring, filtered. The object to be silvered is immersed in the mixture, care being taken that the fluid shall come in contact with every part. The deposition of silver commences in from twelve to fifteen minutes, and continues for two or three hours, until the fluid is exhausted or the object sufficiently plated. The rapidity of deposition depends on the temperature, intensity of light, &c. After the object is plated it should be washed in a solution of carbonate of lime, rinsed in distilled water, and dried.

All sorts of organic matter may thus be treated and hermetically enclosed in pure metal. I have thus coated leather, bone, wool, hair, horn, silk, flowers, leaves, insects, and anatomical preparations. Glass, porcelain, and earthenware may be coated without first using the preparatory bath. If the latter (earthenware) be porous, it will be necessary to first coat it with water, glass, or varnish, otherwise there is great waste of material.

I have before me a sprig of arbor vitæ, on which a dragon fly is affixed, silvered by this method more than six years ago. The coating is without a visible break, though it has been somewhat roughly handled.

Processes with a Battery.—The success of these processes depends upon making the surfaces of the objects to be plated good conductors of electricity. The principles and *modus operandi* are nearly the same in all of them. The object to be plated is immersed in a solution of some easily reducible metallic salt, and kept there until its surface absorbs more or less of it. It is then so treated chemically that the absorbed salts are reduced to a metallic state, and so intimately attached to and connected with the surface of the material to be plated that they will not peel off or separate under any ordinary circumstances. The subsequent treatment is the ordinary electrotypic or galvanoplastic one of plating with any desired metal. On account of their easy reducibility, the salts of silver are those usually chosen for the preparatory manipulations.

Cazeneuve's Method.—Dissolve 40 parts of crystallised silver nitrate in 1,000 parts of wood spirit. Macerate the object in this solution until sufficient absorption has taken place. The length of time needed for this will vary according to the material; the horny shields of beetles, for instance, requiring much longer time than the softer parts, or than a piece of leather. Removing the object from this bath, it is partially dried by draining off any surplus fluid attaching to it, and immersed in the strongest water of ammonia, by which the easily reducible double nitrate of silver and ammonia is formed. The object is now dried and suspended in mercurial vapour. In a few moments the surface is completely metallized, and can be electro-plated in the ordinary manner. This method gives excellent results, especially for hard, compact organic substances.

Oré's Method.—This process is that which has recently been much used in France for plating anatomical preparations, and when properly manipulated gives exquisite results. The preparatory bath, like the foregoing, is silver nitrate dissolved in alcohol or wood spirit, six grammes of the salt to one liter of the fluid. In this the object is immersed for ten minutes, when it is taken out and carefully drained. It is then transferred to a close box, in which sulphuretted hydrogen is liberated and left for fifteen to twenty minutes. When it is removed the surface will be covered with a dark deposit of silver sulphide. The object should be exposed for a few minutes to the air before transferring to the galvanoplastic cell, where the operation is completed. A human brain prepared by this process over a year ago is still a beautiful object, and bids fair to remain so for an indefinite period.

In using this method for the preservation of brains and such material, the object should be kept in alcohol for at least one month to give it the requisite hardness and consistency. Pledgets of cotton should be introduced into the fissures, so that the circumvolutions are separated, and the preserving fluid may penetrate every part. The pledgets must be removed before plating.

From your short notice Professor Christiani's method seems to be a slight modification of Oré's (substituting phosphoretted hydrogen for the sulphuretted in the reduction of the silver nitrate).

To keep Silver Articles bright.—Articles of silver and silver-plated ware rapidly tarnish when kept in rooms where gas is used for illuminating purposes, and everywhere in cities like St. Louis, Pittsburg, Cincinnatti, &c., where the air is constantly filled with sulphurous vapours. My cabinet of silver-plated specimens, instruments, and water pitchers used to give no end of trouble this way. This is all avoided now by dipping the articles occasionally in a solution of hydrosulphite of soda. Large articles, like pitchers and salvers, should be wiped off with a rag dipped in the solution, and dried with a soft towel. A rub with a bit of chamois leather makes them as brilliant as new.

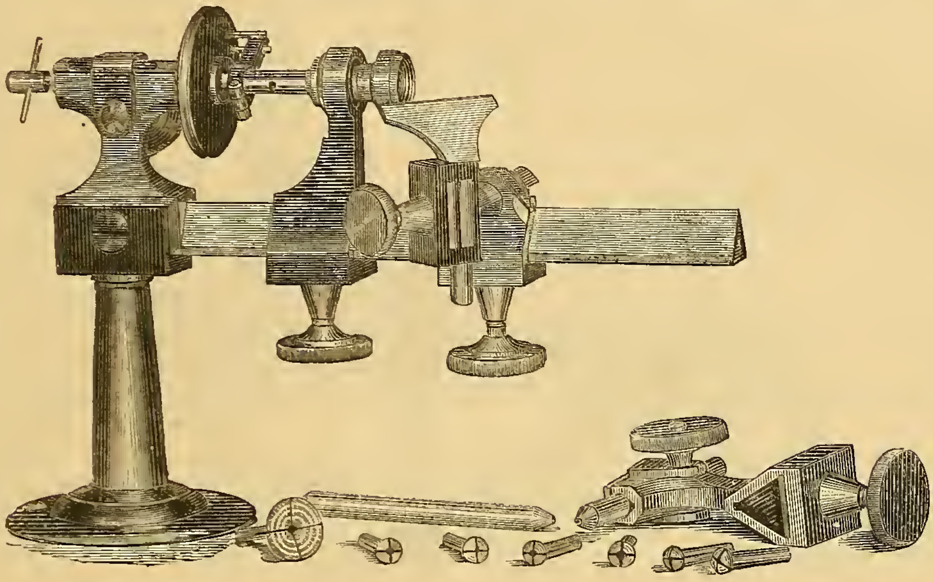
Queries and Replies.

Verta.—Watch Mainsprings are made in England, France, Germany, and Switzerland. Each country has its speciality. If you will describe any kin d of spring you require, and the quantity required, a more definite reply can be given to your question.

Watchmakers' Tools.

The tools manufactured for the trade by Mr, G. Boley, Esslingen, have enjoyed a very high reputation for many years past, but, as far as this country is concerned, only few watch repairers are acquainted with them, so that we think it necessary to give them wider publicity. We can guarantee that the metal workmanship is in all cases of the highest quality.

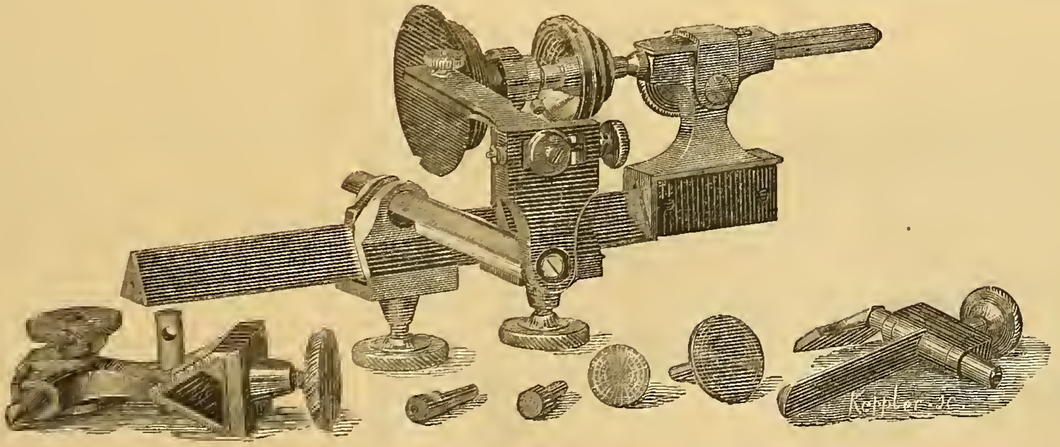
LATHE WITH LUNETTE, AND AMERICAN CHUCK AND PINCERS.



Nos. 1, 2, 8, 9, 10.

The lunette arbor, as well as the rod which carries the loose-pulley, are drilled throughout. You place the tapering pincer in the arbor, whose end is also turned conically at the interior to correspond and to take in the tapering pincer. To make use of one of these, you choose one provided with a hole in accordance with the object you want to clasp; the pincer, which is split into three equal branches, is then placed into the arbor from the front, while you introduce in the back of the rod the tightening screw which takes hold of the end of the pincer. By this means the tapering part of the pincer, split in three, is clasped into the conical part of the lunette-arbor, and holds fast the object you desire to turn. The larger chucks, made on the same principle, are useful to clasp plates, wheels, barrels, &c.; but as the arbor does not allow to place such large cone, one is adapting a large cone on the screw of the arbor. These accessories are very useful; for the objects that are clasped, such as drills, steel rods, &c., are held held fast, and are always set true. It is advisable to have a sufficient number of pincers and chucks, at least six pincers and three chucks.

LATHE WITH LUNETTE AND ACCESSORY TOOL FOR CORRECTING AND POLISHING ANCHORS.



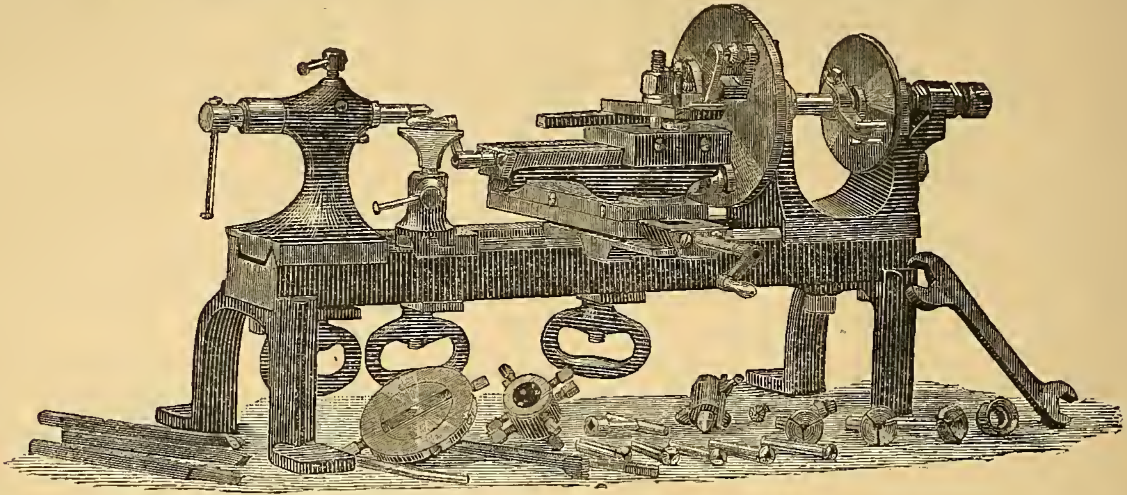
Nos. 1, 14.

This accessory tool to polish and correct pallets ought to be found in any watch-repairing shop, as there are so many anchor watches whose escapements need to be corrected. It is true that putting an anchor escapement in good order is rather a difficult thing, but for a workman who understands properly the principles of the anchor, this tool will prove to be very valuable, if not indispensable. To use it the ordinary rest or support must be replaced by the lever support. The copper-plate loaded with diamond is screwed in the arbor, when it is to chip the stones or the boxwood plate, if it is only to correct or polish pallets. The diamond powder, prepared and mixed with oil, is carefully spread on the surface of that plate; then you place the anchor in a small pair of pincers provided with a pin on one side, causing the pincers to be placed in one of the holes made purposely in the slide of the support.

The support must have a position such that the side of the pallet we are working be perfectly parallel to the surface of the boxwood plate, and we are making all corrections by means of the groove screw.

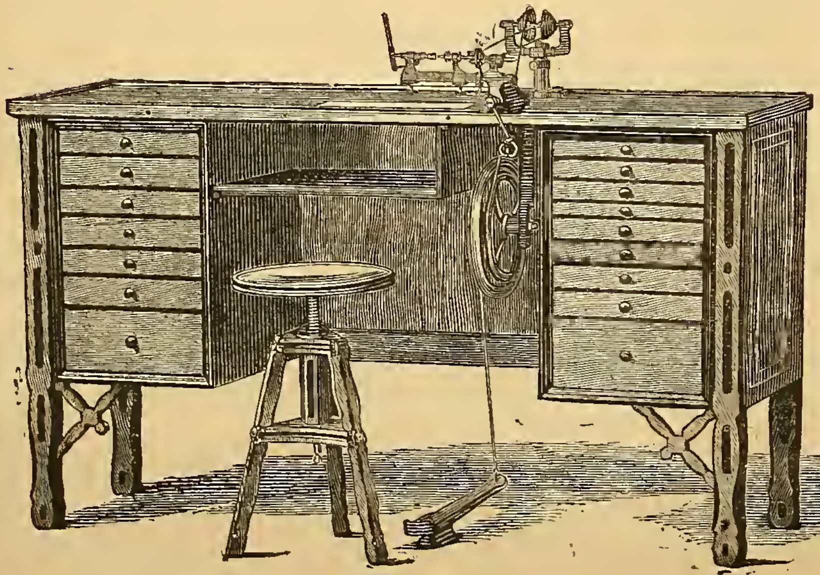
The diamond powder mixed with oil is to be sold in little glass bottles. No. 1 is the coarse; it is used for grinding the stones, while Nos. 2 and 3 are used for polishing.

TURNING LATHE FOR HEAVY WORKS, SUCH AS CLOCKS, TELEGRAPHS, SEWING-MACHINES, AND OTHER USAGES.



This lathe is 500 mm. in length, and 80 mm. in height. Its perch is double, with prism. The arbor and hole-jointings are made of hardened cast-steel; the former and the screw that holds it are drilled right through. The loose-pulley, having three channels, turns upon the screw, and puts the arbor in motion by means of a dragging piece. By this way the tension of the strings has no influence upon the arbor. The poupee has a centre, which is to be moved by means of a screw. The *rest or support* is moveable in every direction. Besides these advantages, this lathe is also furnished with American chucks and pincers, with one slot-chuck and one having eight screws, one carriage support, one platform having three claws, and a centreing-rod; also with a lunette, garnished with boxwood, to turn long and thin steel rods; it has cutters, &c.

To set this lathe in motion, it is well to have a wheel having 700 to 750 mm. in diameter. This wheel can be placed with a stay under the bench or on the floor, or it can be placed with a cranked axle between the supports of the bench.



BENCHES.

Some are made in oak, some in walnut, others in fir-tree painted, but all have the table made of oak. These benches have two chests of drawers placed one on each side. One of them has nine drawers, with divisions for the tools; the other has seven drawers, with divisions for watch-glasses. I furnish also separately these chests of drawers.

BENCH-STOOL WITH IRON-SCREW,

MADE IN ACCORDANCE WITH THE BENCH.

The engraving shows the foot-wheel, the renvoi, the parallel-vice, and a lathe, to indicate how all these tools should be placed.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

XL.

Extraction of Silver.—Liquors containing in the form of a simple salt in solution by an acid are easily treated; add to them an excess of common salt, or hydrochloric acid, the silver will be precipitated as chloride of silver, which, after washing, may be employed for the preparation of new baths, or reduced to the metallic form. Solutions of nitrate of silver, or desilverizing acids, belong to this class. Common salt, however, is without action upon the liquids which hold silver in the state of a double salt, and will rather aid the solution than the precipitation; such are the double tartrate of silver and potash, whitening bath, the double sulphite of soda and silver, and the bath for dipping. Before employing common salt, add sulphuric acid, which, displacing the other acids, restores the silver to the state of a simple salt, easily precipitated by common salt. Hydrochloric acid alone precipitates silver well from these solutions. Liquors containing silver, as cyanide, are also exceptions; to extract all the metal, use the process employed for similar combinations of gold, evaporate to dryness, and reduce the mass in a crucible, with an addition of carbonate of soda and powdered charcoal. The metallic silver remains at the bottom of the crucible. To reduce chloride of silver:—Put well-washed chloride of silver into an iron ladle with a little pure water above the chloride. The greater affinity of iron for chlorine determines its departure from the silver; and, after standing 24 to 30 hours, throw the contents of the ladle upon a filter, and wash thoroughly with pure water; to remove the soluble chloride of iron; the residue will be pure silver in a minute state of division. This method is rarely employed on account of the length of time required. (2.) Well-washed chloride of silver (water does not dissolve a trace of it) is put into a stoneware pan, with two or three times its weight of zinc, and the whole is covered with water rendered acid by sulphuric acid. As soon as they are in contact, these substances react upon each other; the sulphuric acid and the zinc decompose the water, the oxygen of which oxidizes the zinc, which then combines with the acid, and forms sulphate of zinc—a very soluble salt; the hydrogen transforms the chlorine of the silver into hydrochloric acid, which is also very soluble in water. Before filtering, wait until all the zinc is dissolved. The remaining silver is in impalpable powder, and cannot pass through the filter. Wash the silver thoroughly with pure water, and it may then be dissolved in pure nitric acid to form a pure nitrate of silver. This process is seldom employed, as it is difficult to find zinc without lead, which will unite with and follow the silver in subsequent manipulations. (3.) The chloride of silver, freed from foreign metallic salts by washing, is mixed with four times its own weight of crystallized carbonate of soda, and half of its weight of pulverised charcoal. Make into a homogeneous paste, dry thoroughly in an iron pan, and then place in a red-hot crucible. After fusion the heat is raised, in order to allow the smallest globules to reach the bottom of the crucible. Should the crucible be moved at the time of the solidification, the silver will be of a very irregular shape. To obtain granulated silver, pour it in a small stream, and from a height, into a large volume of water.

Extraction of Platinum.—(1.) Render any kind of platinum bath acid by hydrochloric acid, unless it is already so, and then plunge cleansed iron into it. The platinum is reduced to a black powder, wash, and calcine to a white heat. Dissolving it in aqua regia reconstitutes the chloride of platinum necessary for the preparation of the baths. (2.) Reduce by evaporating the bath to dryness, strongly calcine the residue, then wash upon a filter to remove the soluble salts, and again heat to a white heat. The platinum thus obtained is soluble in aqua regia.

(To be Continued.)

The late Election at the British Horological Institute.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—The wheel of fortune has revolved once more at the British Horological Institute, and turned up a trump which I little expected.

By a letter just to hand from Mr. Thos. D. Wright, a graduate of my classes at Charterhouse, I am informed that he has been elected as Professor Perry's successor. This act not only reflects credit on my class, but it practically cancels the condemnation of my system of tuition by the Council, which they never yet had the fairness either to prove or retract.

When the work of my class, which was carried on at my expense, had served their purpose for getting £50 a-year from the Goldsmiths' Company,* I soon learnt that a plan was on foot to get rid of the obligation by getting rid of the teacher. No method succeeded, however, until the Council put its official hand to the plough, and stated that their zeal for the quality of English manufacture prompted them to appoint a committee to organise a new method of class instruction.

This announcement† put my method of tuition under anathema, and made it impossible to proceed until this "new method" should appear. After waiting for it in vain, I challenged the Council through the chairman, at the annual meeting, either to prove the charge which this statement preferred, or to retract or explain it. They would, however, neither do one thing nor the other, nor have I since then ever heard of one act of this committee in relation to the object for which it was called into existence. It must have been a kind of horological bee; it lost its sting in the act of stinging, and died from the effect.

It is, therefore, as surprising as it is satisfactory to me to find that the Council, by its acts of the last few days, has practically thrown the object of this committee overboard, and fallen back on my method in preference. This is shown by the election of a teacher trained under my tuition, and besides, also, by the fact that I have been asked by a gentleman of the Council if I would undertake the class, and informed by him that any suggestion on class instruction would be welcome.

These facts, then, prove that this official statement was made contrary to the conviction and policy of the Council, and was, what I believed it to be, a mere move to checkmate me; but it has only turned out a check after all.

I am, Sir, yours, &c.,

I. HERRMANN.

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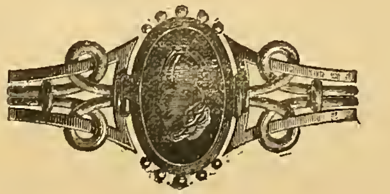
* *British Horological Journal*, p. 68. Feb. 1, 1872.

† *Ibid*, p. 65. Feb. 1, 1872.



Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 37.)

We may say that during the earlier half of the fifteenth century monumental works were, for the most part, in stone, and generally coloured, as were the wooden altars. Tomb slabs in bronze are of much less frequent occurrence, and inferior in execution; of such are some in the Cathedral of Bamberg and elsewhere. The majority are in memory of church dignitaries; and, dating from 1414, through the second half of the century, may be more correctly classed among "brasses;" the effigies being sometimes engraved or cast in outline, sometimes in very low relief. The larger number of these works in bronze were executed by the notable artists and modellers of Nuremberg, first and foremost among whom was the renowned Peter Vischer, on the subject of whose productions an important illustrated work is now being published by Dr. Lübke. Peter was a native of Nuremberg, the son of a brass caster, Herman Vischer, who had made the font at Wittenberg in 1457. The greater part of Peter Vischer's life seems to have been spent at Nuremberg, where he was assisted at his foundry by five sons. Peter Vischer was not, however, merely a bronze caster, he was an artist of profound thought and great inventive capacity, qualities which become manifest throughout his otherwise neutralistic and eminently Teutonic rendering of the subjects he so ably treated.

The Gothic form and ornamentation, mingled with *renaissance* details which pervade nearly all his works, afford a striking instance—parallelled under a different sentiment by the sculptors of Italy in the earlier years of the fifteenth century—of what may be done without, on the one hand, offending the restrictive exigencies of pointed architecture by an over freedom of gesture; while on the other a rigid mannerism gives place to a natural and dignified representation of the figure or subject.

Taking a few of his works in the sequence of this production, we begin with the monument to Archbishop Ernst, in Magdeburg Cathedral, executed in 1495; and that to Bishop Johann, at Breslau, in 1496, in which he already shows an independence of the rigid models of the earlier school. His next recorded work, after an interval of some ten years, displays a still greater advance in freedom from the old manner, and is in every respect a noble monument of artistic skill. This is the well-known shrine of St. Sebald, at Nuremberg, a labour of love, which occupied him from 1508 to 1519. A cast of this grand work is in the South Kensington Museum (No. '69.—14). It may be regarded as representative of the perfection of German sculpture in bronze at the dawn of the sixteenth century, and in this respect should be studied and compared with the same art in Italy; not indeed at the same period, but of some half-century before; and again, as an example of the higher realistic school contrasted with the ideal of the great Italian masters. Admirable as the works of Vischer may be, we cannot but feel that they are by such comparisons found wanting in that high feeling for the beautiful which pervaded the art of Gherbiti, while they are as far removed from the objective sentiment and the heart-stirring power of Donatello. Nevertheless, they engage attention by the simple rendering of the stories represented, and the charm of truthfulness that is infused throughout the whole work. The figures of the Apostles are not without considerable dignity, and a depth of expression which raises them above the realistic; but in the nude figures of the children his modelling is far from excellent, although the play of fancy in the groups has great beauty. The architectural and other ornamentation are admirable, as is the painstaking execution of every detail.

Pankraz Labenwolf was a pupil of the Vischer school, who made, about 1550, the fountain in the market at Nuremberg, surmounted by the figure of a peasant holding a goose under each arm, whence flows the water.

At Aschaffenburg is the monument to Cardinal Albrecht von Brandenburg, of the year 1525, on which the figure of the Cardinal is represented in relief of life size. This is a noble work of high artistic quality. At Wittenberg, in the castle chapel, is the fine monument to the elector, Frederick the Wise; also a figure in *relievo* of excellent art dated 1527, by some supposed to have been executed by his son Peter after the master's design. Two fine bronzes, inkstands, in the writer's possession, are interesting as small objects by a great master; they are varied embodiments of the same idea, which is conveyed by a label bearing the inscription, "Vitam . non . mortem . recogita." A nude female figure (Truth?) is standing at the side of a vase, on which her left hand rests, her right pointing upwards; a skull is on the ground (in one model she thrust it behind with her foot), also a shield and sword or mace; the position of the figures, the form of the vase, and the details, are varied upon each bronze. Upon one the inscription (which is cast in relief) has the initials P. V., and between them the emblem of two fish transfixed upon a spear; beneath the base is the date 1525; on the other the emblem of two fish on a spear is four times repeated among the ornaments upon the vase.

Perhaps the most imposing bronze monument in the world is that to the Emperor Maximilian, in the palace church at Insbruck, the idea of which was conceived and partly planned during his life. As it now remains, a lofty marble sarcophagus, on which is the kneeling bronze figure of the Emperor in prayer—a work of great beauty that has been ascribed to an Italian artist, Ledovico Scalza, of Milan—is enriched with sculptured bas-reliefs, and enclosed with an elaborate grille occupying the centre of the church; while standing, as on guard, and ranged in a row on either side, are statues, about two feet high, of twenty-eight historical personages or relatives of the imperial house. About one-half of the existing statues are ascribed to the court painter, Gilg, including a model for that of the Emperor. In addition to these larger statues, twenty-three of half life size are now in the Silver Chapel, never having been properly arranged in regard to the monument. Some of these figures are works of considerable excellence, those ascribed to Vischer being by far the best; others, again, are rigid and without movement; for the most part the casting and elaboration of details are more admirable than the modelling, but the effect of the whole, particularly when seen in the waning light of evening, is very imposing and solemn.

(*To be Continued.*)

BRITISH HOROLOGICAL INSTITUTE,

Northampton Square, Clerkenwell.

A Class on Theoretical Horology and Mechanics, for preparing Students to pass the City of Guilds Examination in Watchmaking, is held on Monday evenings, from 8 till 9.30, and on Friday evenings, from 5.30 till 7 o'clock, under the direction of Mr. T. D. Wright. Others than Members of the Institute may attend this class for the winter course, on payment of 5s. Application to be made to the Secretary. The full Educational Programme of the Institute is published in the *Horological Journal* for October.

Trade Notes.

His Majesty the King of the Netherlands has appointed Mr. J. W. Benson, of Old Bond Street and Ludgate Hill, goldsmith and watchmaker to the Royal Court.

A self-acting fire alarm and fire extinguisher, invented by Mr. Braham, of Stretford Road, Manchester, was exhibited at the central fire station of that city. The inventor has very ingeniously utilised the effect of a change of temperature upon mercury. A small glass vessel—resembling in shape the bulb of the incandescent electric light—has in the bottom a small quantity of mercury, and a tube, one end of which almost touches the bottom, whilst the other is hermetically sealed to the top. Within the tube is a hollow glass float, which is connected with the mercury, and rises or falls in sympathy with the surrounding temperature. The float as it ascends moves a lever, the raising of which has the effect of turning on a stream of water, and, as an alarm, fires a revolving gun and rings a bell. The stream of water continues until the fire is extinguished, when from a fall of the temperature the mercury descends, the lever is depressed, and the tap of the water-pipe is again closed. The depression of the lever at the same time stops the ringing of the bell, whilst the gun would continue to fire until all the cartridges were expended. The apparatus is simple in construction, is very small in bulk, and costs but little to make. It can be set so as to be affected by a very slight or a very marked change in the temperature, and the water released may be a stream upon one spot or a shower covering a room. Several developments of the system have been designed by Mr. Braham. He has an arrangement by which simultaneously with the firing of the gun and the turning on of the water a fireproof curtain descends, which would shut off one part of a room from another, or the stage of a theatre from the auditorium. A further development is the sending of an electric current to one or more places, and the apparatus is also applicable to the case of a burglarious attempt to open a window or door of a room. An important feature of the invention is that when it has once been fixed it requires no further attention.

A daring robbery was accomplished at mid-day at the shop of Mr. Robbins, optician, 162, Fenchurch Street. An individual called and induced the shopkeeper to go outside, on the pretence of pointing out something he wished to purchase. The shopkeeper, on returning to the shop, met a broad-shouldered fellow, with his hand in his pocket, coming from behind the counter. A struggle took place, which resulted in the shopkeeper being hurled violently backward into the street, and the robber escaping. It was found on examination that he had emptied the cash-box, containing several pounds and a roll of papers. Within a few minutes a dozen constables were on the spot, but too late to be of any assistance.

Messrs. Lund and Blockley, of 42, Pall Mall, have just completed a gigantic clock to the order of Mr. Premchund Roychund, a well-known native of Bombay. Some time ago this gentleman intimated to the Indian Government his desire to present the Bombay University with a new clock and carillons, and, his munificent offer having been gratefully accepted, deposited a large sum of money with the authorities, requesting them to lay it out on his behalf in the manner indicated. Its dials are 13 feet in diameter, of opal glass; it is fitted with an apparatus enabling it to telegraph its time daily to the Observatory, and synchronise to correct time all the other clocks in the University and Bombay City. Connected with it is a carillon of 16 bells, weighing about 12 tons, cast in the ateliers of Messrs. Taylor and Co., which can play 16 tunes and 150 "changes," besides "firing" at full speed, as smartly as though the peal were being chimed by expert ringers. The répertoire of this fine carillon includes Scotch, Irish, and Welsh airs, as well as British melodies, two or three familiar hymns, the National Anthem, and "Rule Britannia."

M. de Villiers has invented a metallic alloy for silvering. It consists of 80 parts of tin, 18 parts of lead, and 2 parts of silver, or 90 parts of tin, 9 parts of lead, and 1 part of silver. The tin is melted first, and when the bath is of a brilliant white the lead is added in grains, and the mixture stirred with a stick of pine wood, the partially-melted silver is added, and the mixture stirred again. The fire is then increased for a little while, until the surface of the bath assumes a light yellow colour, when it is thoroughly stirred up and the alloy cast in bars. The operation is then carried out in the following manner:—The article, a knife-blade, for example, is dipped in a solution of hydrochloric or sulphuric acid, rinsed with clean water, dried and rubbed with a piece of soft leather or dry sponge, and finally exposed to a temperature of 70° or 80° C. (158° to 176° F.) for five minutes in a muffle, to prepare the iron or steel to receive the alloy, by making the surface porous. If the iron is not very good the holes are much larger, and frequently flaws and bad places are disclosed which make the silvering more difficult. With steel the process goes on very regularly. The article, warmed to, say, 140° F., is dipped in the bath, melted in a crucible over a gentle fire. The bath must be perfectly fluid, and is stirred with a stick of pine or poplar; the surface of the bath must have a fine white silver colour. For a knife-blade an immersion of one or two minutes is sufficient to cover it; larger articles require five minutes' immersion. After taking it out of the bath it is dipped in cold water, or treated so as to temper it, if necessary. If left too long in cold water it frequently becomes brittle. It is then only necessary to rub it off, dry and polish without heating it. Articles treated in this manner look like silver, and ring like it too, and withstand the oxidising action of the air. To protect them from the effect of acid liquids, like vinegar, they are dipped in a bath of amalgam, composed of 60 parts mercury, 39 parts tin, and 1 part of silver; then dipped warm into melted silver, or electro-plated with silver to give them a silvery look. This kind of silvering is said to be very durable, and the cost comparatively small.

A Third course of lectures on Watch and Clockmaking will be held at St. Thomas Charterhouse School of Science, by Mr. I. Herrmann, on Monday evenings from 8.30 to 10 o'clock, commencing October 9th. Mr. Herrmann has been so successful with his last two courses, that it is hardly necessary to recommend his teaching; and we only hope, for the benefit of the watch trade, that an increasing number of pupils may avail themselves of the excellent opportunity for instruction and improvement offered by the lectures. We may also remark that Mr. Thomas D. Wright, who enjoyed Mr. Herrmann's training during the last two courses, and to whom we had the pleasure of presenting the *Watchmakers', Jewellers' and Silversmiths' Journal* Prize for 1881, has been selected as teacher at the Horological Institute.

A List of Watches, Watch Movements, Clocks, &c.

The Property of the Worshipful Clockmakers' Company, and Deposited in the Guildhall, London.

(*Continued from page* 40.)

Patey, William.

162. Vertical Movement, with enamel dial, No. 204.
Presented by B. L. Vulliamy.

Perigal, Francis, Royal Exchange, London.

The son of Francis, of the Royal Exchange; apprenticed to his father July 6, 1778; admitted a Free Clockmaker January 9, 1786; made a Liveryman January 8, 1787; chosen on the Court of Assistants January 1803; served the office of Warden, 1853-5; Master, 1806.

163. Horizontal movement, jewelled, capped, No. 17912.
Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Pinchbeck, Christopher, London. (See Portraits.)

164. Small Repeating Movement, cap and bell, enamel dial, No. 56.
Presented by B. L. Vulliamy.

Pike, John, London.

Served the office of Steward of the Company in 1838.

165. Vertical Movement only, No. 1998.
Presented by B. L. Vulliamy.

Quare and Horseman, London.

Daniel Quare, "a great clockmaker," admitted and sworn a Brother 3rd April, 1671; chosen on the Court of Assistants, 1697; served the office of Warden, 1705-1707; chosen Master 29th September, 1708. In 1676 he invented the repeating movement in watches, by which they were made to strike at pleasure.

166. Repeating Movement (Stockden Motion), jewelled, no dial, No. 1117.
Presented by Messrs. T. B. Adams & Sons, 1850.

Robinson, Francis, London.

Apprenticed to Thomas Williamson, 3rd March, 1672; served the office of Warden in 1722-24; chosen Master in the room of Joseph Williamson, deceased, 7th June, 1725.

167. Repeating Movement, with enamel dial, No. 34, having a silver cap, upon which is engraved, "Servant to His Royal Highness."
Presented by B. L. Vulliamy, 1849.

Romilly, à Paris.

168. Silver single case, No. 25,382.
Presented by B. L. Vulliamy.

Reynolds, T., St. Martin's-le-Grand.

169. A Vertical Watch, in metal case covered with tortoise-shell, No. 7081, a fine specimen of this description of work.
Presented by Messrs. F. B. Adams & Sons, 1849.

170. Plain Vertical Movement, square pillars, wanting dial, No. 859.
Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Senin, P., á Paris.

171. Portable Silver Sun-dial Compass, engraved.
Presented by J. Grant, 1853.

Skinner, Matthew.

Served the office of Steward in 1735; elected on the Court of Assistants, April 4th, 1743; chosen Warden, 1744-5, and Master, 29th September, 1746.

172. Vertical Movement, silver cock.
Presented by Deputy S. E. Atkins, Clerk to the Company, 1873.

(*To be continued.*)

Compensating Pendulum.

Mr. James Asher, of Fort Erie, of the Province of Ontario, Canada, has recently patented a compensating device for the expansion and contraction of clock pendulums and their supporting parts, and thereby preventing irregularities in the clock movement from the expansion of the pendulum. On the front plate of a clock frame, made of brass or other metal, a pendulum is suspended by its spring from one end of a lever, pivoted at its other end to the front plate. The spring passes through the usual split stud on the plate, the stud being the centre on which the pendulum swings. A support projecting downward from the frame sustains a rod, the upper end of which touches the pendulum-supporting lever at a point near its pivot. The lever is of the same metal as the frame, and the rod is of zinc or other metal whose co-efficient of expansion is greater than the metal used in its support. When the temperature falls below the normal the pendulum rod and the plate contract, and with the ordinary construction would shorten the pendulum; but in this case the zinc rod also contracts, and allows the line to drop, and the movement being multiplied on the outer end of the lever, the shortening by contraction is thus compensated; and it will be seen that a reverse effect will take place when the pendulum and plate expand.

Index to Antique Rings and Ornaments.

60—Toadstone ring, in the Londesborough collection.

61—Signet ring found in the Severn near Upton; probably a work of the 15th century. It is of silver and has been heavily gilt. The hoop is spirally grooved, and upon the circular face is a large letter H, surrounded by branches.

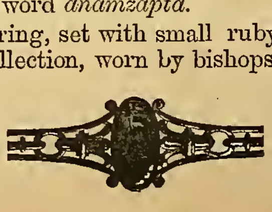
62—Ring in the Londesborough collection, representing a toad swallowing a serpent. It is of mixed metal gilt.

63—Brooch discovered in Ireland, and now in the possession of Mr. Waterhouse, the goldsmith, of Dublin. The engraving is full-size of the original, only the length of the plain pin has been curtailed. It was accidentally found by a peasant near Drogheda. It is of bronze, decorated with gems and ornament in enamel. Probable date, 12th century.

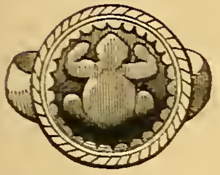
64—Episcopal ring in the Londesborough collection; 12th century.

65—Ring in the same collection. It is somewhat roughly formed of mixed metal, and has upon the circular face a conventional representation of a monkey looking at himself in a hand-mirror; this is surrounded by a cable moulding, and on each side is set two large stones. The outer edge of this ring is also decorated with a heavy cable moulding. Inside, next the finger, is the cross and sacred monogram placed on each side of the mystic word *anamzapta*.

66—Gilt copper ring, set with small ruby, in the Londesborough collection, worn by bishops over the glove.



ANTIQUE RINGS AND ORNAMENTS.



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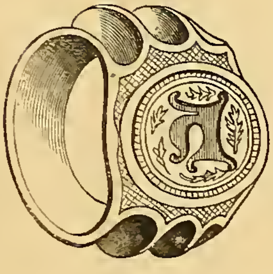

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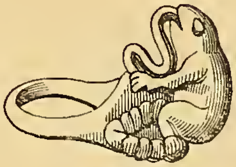

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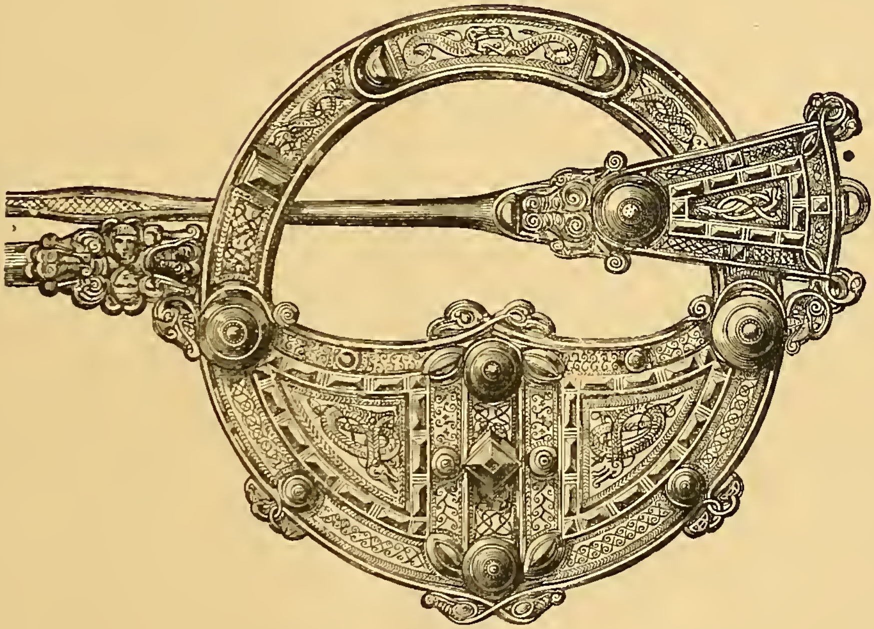

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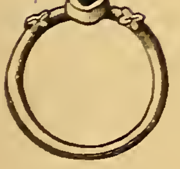

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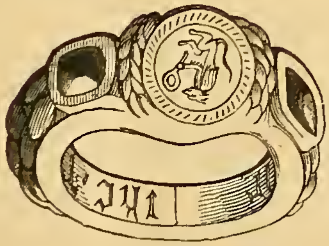

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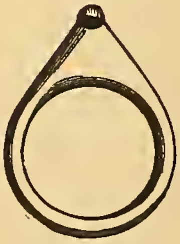
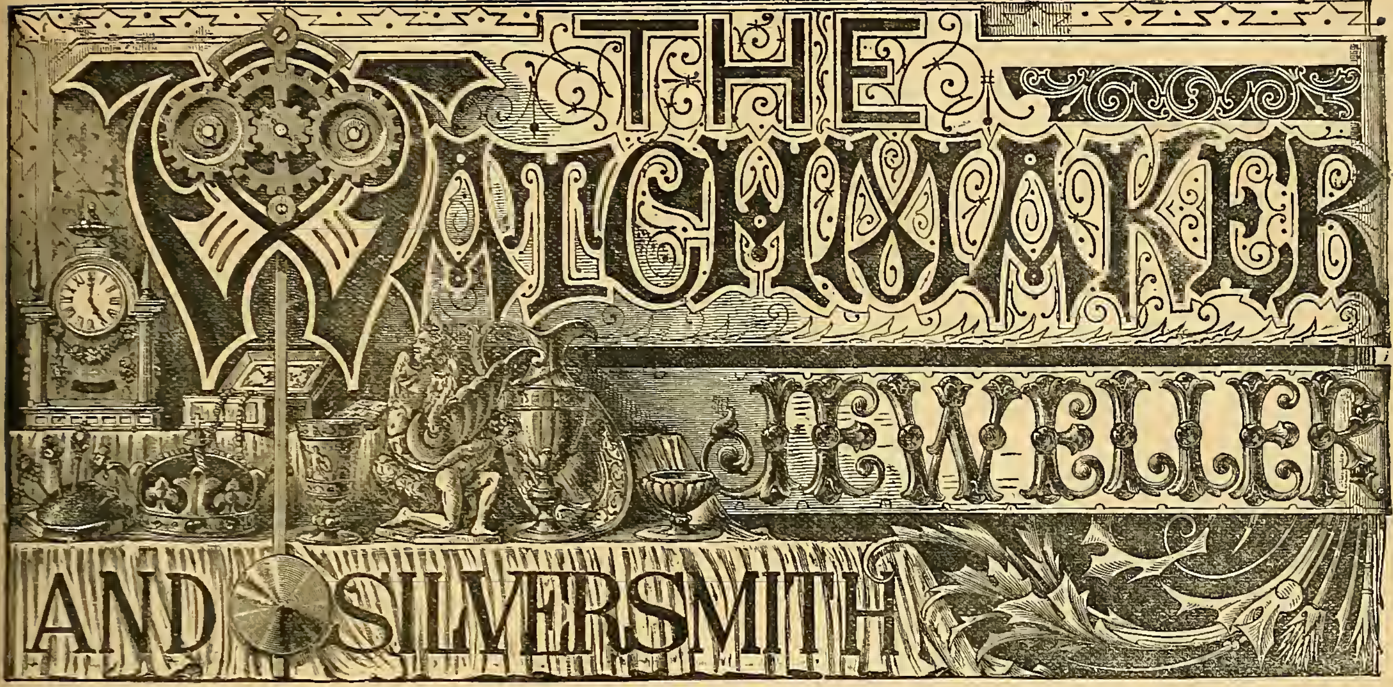


66.

For Description see page 52.



THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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ILLUSTRATED SUPPLEMENT :—Designs for Modern Jewellery.

No. 90.—Vol. VIII.] NOVEMBER 6, 1882. [Subscription, 5s. per Annum. Post Free.

Our National Watch Factory.

By a Horological Zadkiel.

(Continued from page 28.)

[Owing to unforeseen hindrances, we were unable to complete the necessary engravings for illustrating "Zadkiel's" description of some of the tools employed at the factory, and are therefore compelled to omit for the present the first part of his contribution.—Ed.]

Six years previously, viz., in 1880, Jonathan had seen a similar collection at Geneva, where an exhibition of the machines and tools used in watchmaking and the kindred branches of industry was held under the patronage of the Classe D'Industrie, and the Société des Arts, and which went far to disprove the statements that America was the only country where machinery was systematically used for the manufacture of watches on a large scale.

A manufacturer of high-class watches in Switzerland, while smarting under the statements made by M. Favre Perret, as to the superiority of American watches, wrote to him in 1878 as follows:—

"You say, in America everything is done by machinery; here, in Switzerland, everything is done by hand. Question: How can this statement be reconciled in the face of the fact that Switzerland is overflowing in her abundance of watch-machinery? In Geneva we find factories with long lines of machinery of the choicest kinds, some running with power derived from immense water-wheels, others by water engines. Many of these machines are wonderful specimens of ingenuity. I have never yet seen in any American factory useful machines equal to many which are running every day in Geneva. . . Nor can Geneva alone boast of her elaborate machinery, and other facilities for watchmaking, over other parts of Switzerland. In some of the mountain districts—for instance, the Vallée-du-Lac-de-Joux—even there you will find watch-factories furnished with the most improved machinery, and running by steam power. . . . Take, if you please, the highest cost watch made in America, and compare it piece by piece with even the medium grades made in Geneva or Locle. You will find both are made by machinery; the die, the milling tool, the lathe, &c., have all played their part in one and in the other. In the case of the American production, the work on the movement ends when the machines have got through; while, on the contrary, much of the work on the Swiss watch only commences when the machines leave off. Just here is where skilled labour steps in, and by means of dexterous manipulation, the work of finishing is carried to a degree approaching the marvellous."

The foregoing statements, so far as they related to the excellence of the Swiss system, were fully substantiated by the exhibition referred to, in which 90 firms were represented. It is only due, however, to English horologists to state that the idea had been set on foot by the spirited little attempt at the British Horological Institute in 1873, concerning which the *Times* closed a full review by saying, "It can hardly fail to lead to a much more considerable display in future years, as well as to a more extended knowledge of the merits of English watchmakers."

This was followed by the interesting and admirably arranged Loan Exhibition of scientific instruments held at South Kensington, under Government management, in 1876, and which Her Majesty the Queen was pleased to honour by a private visit prior to its being thrown open to the public. At that Exhibition it was conclusively shown that English inventors and mechanicians were able to hold their own against those of any other country, though many of them were able to find more profitable employment abroad.

Jonathan, while admitting the truth of much that was advanced by the Managing Director, very pertinently inquired how it was that most of the more important machinery he saw around him was of American manufacture.

Mr. J. Turner Pivot admitted that the question could not be answered in a manner that was altogether gratifying to our national pride, but the fact was that America was the only country where any organisation existed for the supply of horological machinery.

The Swiss manufactured it for the exclusive purpose of doing their own work, whereas the American watch tool Company, with characteristic enterprise, laid themselves out to supply the wants of the world; therefore, after much hesitation on his own part, he was compelled to recommend his colleagues to put themselves in communication with the American Company, who in May, 1884, replied to the folfollowing effect:—

"This Company are engaged in the planning of and equipping watch factories. We have planned five factories, building and fully equipping them since 1879, previous to which the writer was at the head of the American Watch Factory for many years, being connected with it from 1857 to 1876.

"We have all the needed drawings and patterns for such work, and skilled workmen now employed on work for three watch and six clock factories; therefore we feel prepared to contract for the entire plant of a watch factory doing business on the principle on which the American watches or clocks are made.

"On the American plan a watch is made by special tools adapted to it, and although there are many general tools, such as wheel, pinion, and ratchet cutters, turning lathes, &c.; still, a study of the watch to be made is necessary to plan tools to manufacture it cheaply; therefore, before we could give a close estimate of cost, we must see the watch, but for a rough estimate would say, from 75,000 dols. to 85,000 dols. would equip you to make 200 per day of a medium grade, such as Waltham and Elgin Companies are making. Should you finally decide to adopt the American system, I would advise a visit here to gather all needed experience, and to make contract for tools.

"This advice was given, and followed by a well-known provincial firm, and a mutually satisfactory arrangement was made by which we built them a large line of tools, since which time we have doubled our facilities and vastly improved in skilled workmen, so that we are able to guarantee satisfaction."

On the receipt of the above letter, a preliminary consultation was held, and as neither Mr. J. Turner Pivot or Mr. A. Compensation were able to leave their respective businesses for a lengthened period, Mr. George Template, in whose judgment as a practical mechanician much reliance was placed, was selected to arrange matters with the American Watch Tool Company, on the personal guarantee of John Mainspring, Esq., in order that the manufacture should begin very shortly after the scheme was brought before the notice of the public.

Mr. Template spent a pleasant and instructive time while employed on his mission of enquiry, and returned shortly before the close of the year (1884).

After further negotiations, a staff of skilled workmen were sent over, who at once set to work constructing machinery in a room in a foundry fitted up for the occasion. When a certain amount of progress had been made, the factory premises were designed and built, being brought to their present state of completion in a little over a year.

Jonathan now thought that he ought to see something of the actual work that was being done, as the time at his disposal was rapidly passing away, so he was at once conducted into a large, well-lighted apartment, having lines of pully shafting overhead along each side of it. The shop was of sufficient width to accommodate four rows of benches, and upon those were the various machines and machine tools, driven by the shafting referred to in the last article.

Upwards of seventy respectable-looking young men and women were directing the several operations entrusted to them, and the most remarkable feature was the absence of all noise from the machinery and the smartness with which the operatives attended to their work. Strict discipline was the order of the day, and the old motto, "A place for everything, and everything in its place," was carried out to the letter. The various stages of movement making were going on here, from stamping the discs out of sheet brass to drilling the holes for the escapement pivots. In this department the greatest *show* of work was made; but it was in the next, designated the "train shop," where the most beautiful operations were to be witnessed. Each movement required upwards of twenty pieces from this room, involving 600 different operations, and it was quite impossible for Jonathan to attempt to examine them properly at the present moment; therefore, with many thanks to Mr. J. Turner Pivot, for the courtesy with which he had been treated, he took his departure, promising to call again at an early date.

On leaving, he was distinctly heard to mutter, "Shade of Washington! they'll beat us yet."

(To be Continued.)

Safety Pinions.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—Mr. R. Whittaker, writing on the above subject, on page 28 and 29 of this volume, quotes several eminent authorities on the matter of damage to the centre pinion, by the breaking of the mainspring in going barrel watches, from which it appears that there is a considerable divergence of opinion on this point among "practical men."

I believe all the experiences recorded in Mr. Whittaker's essay may be verified under certain conditions, and that all of them rest on a common basis. This I think I can show and point to a very simple remedy, and will make it an item of class instruction in the present course. If, therefore, any of your subscribers feel any interest in the matter, and are disposed to pay me a visit on the occasion, either at Charterhouse or the Polytechnic, they are welcome to do so. I would simply ask that they favour me with their card through your office, and will acquaint them of the terms.

Yours, &c.,

I. HERRMANN.

The Worthies of Horology.

By C. Stuart Murray.

VII.

In finally dealing with the great Strasburg clock, I passed over the regular historical order in my last; but I will now resume my place among the lights of the "antiquaries."

Sassi, or Saxius, in his "Historia Typographica Mediolanensis," amongst other Milanese poets, mentions Gasper Visconti, a member of the noble family of that name, and equally illustrious himself by his learning as well as by his birth. In Sassi's selection from Visconti's poems, he found a sonnet written in the year 1494, which distinctly alludes to the work of some great horologist of an early period. The poem is in Latin, but the following may be accepted as a suitable translation:—"Certain small and portable clocks are made, which, with a little ingenuity, are continually going, showing the hours, many courses of the planets, and the festivals, and striking when the time requires it." The sonnet is, as it were, composed by a person in love, who compares himself to one of these clocks. There is a modern form of pocket time-keeper called clock-watches, which are pretty well known to two classes of people, namely, those who have an ordered one left on their hands, and those who have paid £100 for one, that sum being the price "per head." It may, perhaps, interest many of my readers to hear that clock-watches were made with certain astronomical striking actions as far back as the latter part of the 16th century! Visconti, in his sonnet, mentions a certain hidden force in action day and night within the heart of the instrument, as well as the sound of a little bell, which was so elegantly alluded to by Froissart, which was given in the August number. The inventor of these clock-watches is not known for a certainty, whilst the only way to obtain any reliable information upon the matter would be by consulting Gaspar Visconti's manuscript works in the library of St. Barnabas at Milan. The question waiting for, or wanting absolute settlement, would be whether or not these portable clocks were made before 1494. Visconti died in 1499.

Sassi, previously quoted, gives an opinion from the result of his own researches. He says that Domenico Manni, in his "Commentarium de Florentinis Inventis," seems inclined to the belief that clock-watches were the invention of one Lorenzo de Vulparia. Of Domenico Manni it is stated that he was a writer, printer, and antiquarian of great eminence in Florence in the early part of the eighteenth century, and published his "Commentarium" at Ferrara in 1731. In a chapter treating of horological instruments, the celebrated Benvenuto Cellini is named as an authority testifying that "Laurentius de Vulparia, a most excellent workman in the manufacture of clocks, and very good astronomer of Florence, constructed a most remarkable clock, and that he was the first who reduced into a material sphere the movements of the heavenly bodies and planets, to the wonder of all who saw it."

Manni further adds a Latin letter, of the date of August, 1484, from one Angelus Politianus, to a friend named Franciscus Casa, containing a detailed account of this clock, wherein he describes it as "a square pillar, nearly three cubits high, tapering like a pyramid to the top, and ending in a point surmounted by a brazen sphere nearly one cubit in diameter, on which are exhibited the courses of all the planets and heavenly bodies, moved by small toothed wheels within. This machine was, therefore, a planetarium, or orrery, and evidently not portable." Nothing is said of the moving power, which might easily have been a weight within the square pillar on which the sphere rested.—*Vetusta Monumenta.*

This is the authority upon which rests the claim of Lorenzo de Vulparia, the famous Florentine, to be one of the ancient worthies of horology.

I have read of a clock which was much valued, having been put up at Spina in the year 1395; thus, Lehman:—"That year the clock was erected on the Altburg gate. The bell for calling the people together for divine worship was cast by a bell-founder from Strasburg. The works of the clock cost fifty-one florins." Lehman does not state the name of either the clockmaker or the bell-founder. About thirteen years before that time, namely, in 1382, Courtray, a town in West Flanders, about twenty-five miles from Bruges, had a very good clock for the period. It so happened, however, that a certain regal gentleman who rejoiced in the name and title of "Philip the Bold," Duke of Burgundy, fell seriously in love with that clock. Froissart tells us that it was one of the best to be found, either at Courtray or beyond the sea; because, in addition to keeping good time, it struck the hours in regular order. We are not told who made it, but what we are told is, that the duke had it taken to pieces, and, with its bell, carried off to the town of Dijon in Burgundy; "and was there put together again and set up; and there it strikes the four-and-twenty hours in the course of day and night." Professor Hamberger says:—"The greater part, however, of the principal cities of Europe were, at this period, without striking clocks, which could not be procured but at a great expense."

Most readers of European history have heard of Venice; the Venice of artists, warriors, politicians and poets; and not without good reason, as the annals of Europe testify:—

"I stood in Venice, on the Bridge of Sighs;
A palace and a prison on each hand:
I saw from out the waves her structures rise
As from the stroke of the enchanter's wand:
A thousand years their cloudy wings expand
Around me, and a dying glory smiles
O'er the far times, when many a subject land
Looked to the winged Lion's marble piles,
Where Venice sat in State throned on her hundred isles.

She looks a sea Cybele, fresh from Ocean,
Rising with her tiara of proud towers
At airy distance, with perpetual motion,
A ruler of the waters and their powers:
And such she was;—her daughters had their dowers
From spoils of nations, and the exhaustless East
Pour'd in her lap all gems in sparkling showers.
In purple was she robed, and of her feast
Monarchs partook, and deemed their dignity increased."

The quotation will be recognised as from Byron's "Childe Harold," and I have given the two most descriptive stanzas of the grand "Queen of the Adriatic" in the plenitude of her matchless beauty and her power; yet, notwithstanding all this, she did not obtain her public clock until the year 1497; and who the maker of it was no one seems able to know. If there had been an horological worthy in all Venice, there can be little doubt but that his name and quality would have been preserved by so proud a community.

It may not be out of place to explain here, for the information of those not acquainted with the matter, as to who Cybele was, and why Byron poetically likened Venice to her. She was a goddess of mythology, and had temples and worshippers. After the manner of all her kindred, she was "no better than she should be," whilst the condition of her worship-ceremonies were—"not to put too fine a point upon it"—far from what we should consider good enough for nineteenth century morality. Those ceremonies drove men mad. So large a share of attention did the doings of her and her "belongings" occupy, that they employed the pens of Virgil, Lucian, Ovid, Lucan and other classic writers. It is supposed that her "mysteries" were practised about 1,600 years before Christ. The world's literature would have lost little had they never been known. The reason why Byron used her as a simile for the impersonation of Venice was, that she was represented as holding keys in one of her hands, signifying government, and having a crown of turrets upon her head, indicative of grandeur and power.

As I move towards the close of the fifteenth century my inquiries lead me into the company of more learned personages, including one who can scarcely be deemed to be out of his 'teens. Ambrosius Camaldulensis writes thus to Nicolaus, a learned man of Florence:—"When I received your letter I immediately made ready your clock, and should have sent it had any one been at hand to have taken it. I have caused it to be cleaned, for it was full of dust, and thus as it could not go freely it was retarded; and because it could not thus run correctly, I gave it to that illustrious youth Angelo, who is most skilful in these things."

Now who was "that illustrious youth, Angelo?" The letter itself is in Latin, but I have been unable to learn anything more about this juvenile "Worthy of Horology." In the original the text runs, "Angelo illi illustri adolescenti," but how he came to be illustrious and "peritissimo"—most skilful—I cannot learn.

I now come to the eminent name of Peter Hele, of Nuremberg, who has been largely credited with the invention of watches, but with disputation. The objection against this grand old "Worthy of Horology" is hardly sustainable. Most of it rests upon what I have previously stated, about Lorenzo de Valpariâ, and cannot very well be argued out here. I think that, as far as I can see at present, Doppelmayer is right in standing by the claims of Hele. We have now got into the early part of the 16th century, about which period the horological sky began to be a little clearer. Nothing is more trying and troublesome for a writer in my position than to be sweating and digging among authorities in order to clear a way, as it were, through the misty brushwood of antiquity for himself and his readers. What is more, he is expected by *some*—thank heaven—to do so without making as much as a single stumble, or going wrong even one compass-point in direction.

The ancient city of Nuremberg has been long famous for its superior mechanical ingenuity, and also for its astronomical talent. It has steadfastly held by the claim that it produced the first "Nuremberg eggs." I may here say that that was the name given in a playful sense to watches, although, otherwise the Germans called them "pocket-clocks." In this talented city the horological art in connection with watches first stood upon firm ground, leaving no room for any doubt whatever. I have now to quote a very learned authority upon the question.

John Gabriel Doppelmayer was for many years Professor of Mathematics at Nuremberg, in which city he was born in 1677. He published there, in 1733, a very interesting book, entitled, "Historical account of the Mathematicians and Artists of Nuremberg." In this account will be found the following paragraph, which must have settled many precious disputations:—

"Peter Hele, a clockmaker, was everywhere held to be a great artist, on account of the pocket-clocks which, soon after the year 1500, he first made in Nuremberg, with small wheels of steel. The invention, which may with great justice be ascribed to him, being something quite new, was praised by almost everyone, even by the mathematicians of the time, with great admiration. He died in 1540."

Again:—"This, already so written by Coccleus in 1511, shews, in the clearest way, that pocket clocks were made in Nuremberg 219 years ago (dating from 1733), and he has fairly attributed the invention of them to this artist, since it was the most deserving of admiration, and the newest of his time, and which will be considered as a Nuremberg invention; whence, also, clocks of this kind were, for a long time called Nuremberg living eggs, because they, at first, used to make them in the form of small eggs; which name is even to be found in the German translation of a strange book which F. Rabelais has left behind him, in chap. 26. Hence, it is evident how erroneous it is to ascribe, as many do, the invention of small striking clocks, as of these pocket clocks, to Isaac Habrecht, a well-known mathematician, who lived about the beginning of the last century, and dwelt at Strasburg, whereas our Peter Hele had made them in Nuremberg one hundred years before."

"This, already so written by Coccleus in 1511," mentioned above, was what he said of Hele in his learned "Commentary on the Cosmographia of Pomponius Melâ, which was published at Nuremberg in the year named. The work is, as was the custom of the learned in those days, written in Latin, and the immortalised Worthy of Horology is thus introduced to the reader:—

"Inveniuntur in dies subtiliora," &c., and runs on:—"This young man has performed works which the most skilful mathematician may admire. For he makes small watches of steel, with numerous wheels, which, as they move without any weight, both point out and strike forty hours, even though they are contained in the bosom of the pocket."

As I am now speaking of a very important epoch of horology, and of authorities equally so, I will give to those readers the original, of which the above is the best rendering in my power, in order that they may, if they so please, translate for themselves:—"Eum juvenem adhuc admodum, opera, efficere, quæ vel doctissimi admirentur mathematici. Nam ex ferro parva fabricat horologia plurimis digesta rotulis, quæ, quæ cunque vertantur, absque ullo pondere, et monstrant et pulsant XL. horas, etiam si in sinu marsupiore contineantur."

Coccleus was born in 1479, and he accurately described a clock, or striking watch, in his work, dilating upon it as a wonderful novelty, especially dwelling upon the singularity of its going without any weight, and of its astonishing the mathematicians of the period. Now, we have been told that these watches were known in Milan in 1494, but mechanical explorers cannot understand why such novel and complicated instruments should be well known in Milan 1494, and yet that Nuremberg, so celebrated for its clockmakers at that time, should not have heard of the new invention until fifteen or sixteen years afterwards; and that even then, they should have come upon the Nurembergers as something that had never been heard of before; in fact, as a new discovery altogether. As there are here some materials for the "learned" among modern horologists to exercise their brains upon withal, I will just leave it as it stands.

(*To be Continued.*)

◆

Cement for Filling Faults in Iron Castings.—Iron filings, free from rust, 10 parts; sulphur, ½; sal-ammoniac, 0·8. These are mixed with water to a thick paste, which is rammed into the "faults." This becomes strong when the iron filings are rusted. The parts which have to be cemented are treated before the operation with liquid ammonia, so as to be perfectly free from grease.

Fireproof Iron Cement.—(1) Iron filings, 140 parts; hydraulic lime, 20; quartz sand, 25; sal-ammoniac, 3. These are formed into a paste with vinegar, and then applied. This cement is left to dry slowly before heating. (2) Iron filings, 180 parts; lime, 45; common salt, 8. These are worked into a paste with strong vinegar. The cement must be perfectly dry before being heated. By heating it becomes stone hard.

Swiss Watch Repairing.

By Hy. Ganney.

THE Duplex Escapement being often found amongst Swiss watches of a high-class character, but not of very recent make, a thorough knowledge of this escapement is necessary to any one who desires to be considered a competent repairer of Swiss watches. Opinion is very much divided as to the merits of this escapement; some asserting it to be the very best, and others equally positive it is the very worst possible escapement for pocket watches. Theoretically, it would seem to approach nearer perfection than any other, and the most important recent invention in clock escapements, viz., Dennison's Gravity Escapement, will appear to be based on the same duplex principle, which is also apparent in the chronometer, with the addition of complete detachments, which is by some considered the first consideration in an escapement, and by others a disadvantage in such a small mechanism as a watch escapement; in which, complete detachment means a difficult and uncertain action of the action on the balance axis. It is claimed for the duplex escapement, that the constant contact of the wheel tooth on the duplex roller, gives its chief value to it, forming a compensation both for changes of position and temperature, and changes in the motive power and the condition of oil, uniform and self-acting. That something of the kind does take place is evident from the good esteem and high character for time-keeping these watches have had from competent observers. The constant pressure against the side of the balance holes equalises and divides the pressure on the end stones, and prevents that increase of vibration always seen in free escapements, and the constant friction on the roller absorbs and renders of no account a number of minor frictions caused by different actions of the escapement and change of pull and weight of hair spring, &c., all important factors in detached escapements. Changes in oil and motive force, usually most injurious to free escapements, are in this escapement compensating; as the power of the mainspring increases or diminishes, so the friction on the jewel roller varies, and the extent of vibration may be made uniform. The thickening of oil in cold weather having a tendency to retard the vibrations of the balance, forms a compensation for temperature often as effective as natural. The different opinions concerning the duplex escapement may be partly explained by the various ways in which it can be made. In nothing is a ripe experience so valuable as watchmaking, as a lifetime is not sufficient to thoroughly test the value of any horological idea, and there is a tendency always to run to extremes, first one way then the other, when real success is only to be obtained by a golden mean, and leaving well alone. M. Saunier, in his valuable work, gives the English credit for making the most sensible and perfect duplex watches; and a consideration of the differences that may be noted will be most valuable. A constant tendency to set or stop from sudden motion is the chief fault complained of.

Conversing with one of our most competent duplex and chronometer escapement makers, Mr. Nelson, he asserted his ability and constant practice of making these escapements so that the wearer could not stop them without touching the balance. Another eminent chronometer maker, Mr. Crisp, I know, always puts his pocket chronometers to time, when rating, by stopping the watch by a dexterous twist, and starting it again when the seconds hand coincides with the regulator; moving the seconds hand, if tight, being dangerous to a chronometer.

The duplex escapement having only one impulse at every two vibrations, we shall perceive that a certain amount of motion must be given to the balance one, in a direction to cause it to unlock by the act of the long tooth falling into the notch of the ruby roller, and another in the opposite direction, to cause the short or impulse tooth to act on the pallet, as one operation is as necessary as the other. The hair-spring must cause the pallet and notch to travel equal distances to act, as any advantage given to one increases the difficulties of the other, and when the balance is at rest, moving it carefully in either direction with a peg if the actions are not at equal distances from the point of rest, the hair-spring must be moved to secure the desired result. Unlike every other escapement, a large amount of drop on to the pallet is a distinct advantage, and with some proportioned escapements necessary to get a performance; without considerable drop, the impulse tooth, when the balance is moving hourly, may catch the point of the pallet instead of falling some distance up it. Moving the pallet away from the ruby notch increases the drop, and diminishes the acting angle of the escapement, allowing it to start with less amount of movement of the balance, which is an advantage; at the same time, the amount of force and impulse given to the balance is diminished, which is only a secondary evil; and where the vibration is great, such as we look for in a lever watch, it must be diminished, as a large excursion of the balance enables two impulses to be given with only one vibration, causing a very rapid gaining rate occasionally; and large vibration is also usually found with light balances and large angled escapements.

A small ruby roller favours a good vibration, but makes the action of the escapement very difficult; as with a fair-sized roller, the action of the long teeth is very delicate. When the long teeth are worn, they may be tipped in the turns and refiled and pointed, the pallet shortened, and the escapement put closer; or a larger ruby roller may be put with advantage. The condition of the pivots and holes is of the first importance, as side shake, and end shakes, which would have no injurious effects in other escapements, are fatal to the duplex. Steady pins and screws must fit well, and these points will be apparent to any one who notices how light and delicate the connection and point of contact must be between the ruby roller and the long teeth; a trifle either way making all the difference between a depth too deep or too shallow. An intelligent study of a good drawing of the duplex escapement will be a great help to an understanding of the points that must be attended to in an attempt to alter or repair one. The principal points in the duplex escapement are very similar to those of the chronometer, which may be considered a form of the duplex escapement, with the addition of detachment, a consideration of which we will give in our next article; as the Swiss are very clever in making a large number of cheap, but not very good, pocket chronometers.

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BRITISH HOROLOGICAL INSTITUTE,

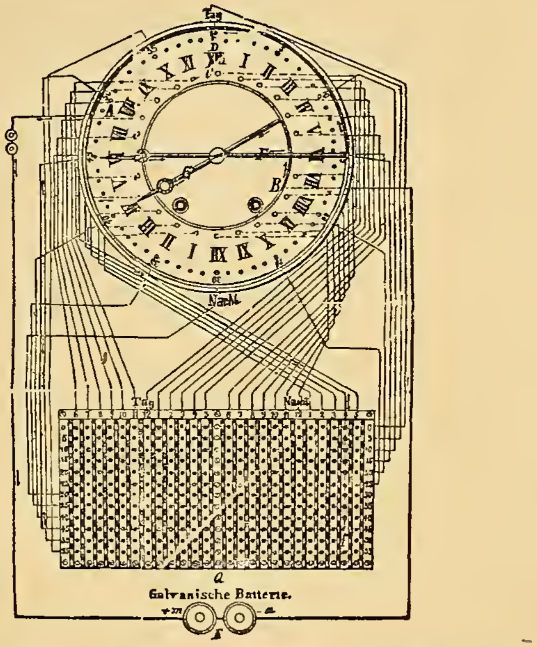
Northampton Square, Clerkenwell.

A Class on Theoretical Horology and Mechanics, for preparing Students to pass the City and Guilds of London Examination in Watchmaking, is held on Monday evenings, from 8 till 9.30, and on Friday evenings, from 5.30 till 7 o'clock, under the direction of Mr. T. D. Wright. Others than Members of the Institute may attend this class for the Winter Course, on payment of 5s. Applications to be made to the Secretary. The full Educational Programme of the Institute is published in the *Horological Journal* for November.

New Foreign Patents.

ELECTRICAL SIGNAL CLOCKS. R. P. No. 14646, K. I. 21. R. L. Metzger, Alt-Breisach, Baden.

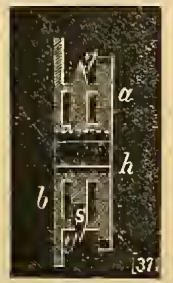
The clock consists of a clock movement, an electric bell, contact index, dial, and a galvanic battery. On to the dial, made of isolating material, are fixed two contact rims A and B, and 24-hour contact points C, and 60-minute contact points D. The hour and minute contact points are made of metallic conductors, which are connected by conducting wires at the back of the dial. Each of the 24-hour points C, and each fifth-minute point D, is connected with the contact indicator Q; and the contact rims A and B are each connected direct with the positive pole m and the negative pole a of the battery E.



The clock hands F and G have contact points on their ends, which touch the contact rims A and B, and alternately the hour and minute contact points.

The contact indicator Q consists of 24 vertical and 12 horizontal isolated metal laminas, which are connected at their crossing points by contact pins F. The illustration shows the clock giving a signal at 4.45 a.m. As the minute hand moves once every minute, the contact is maintained, and the bell sounds for that period.

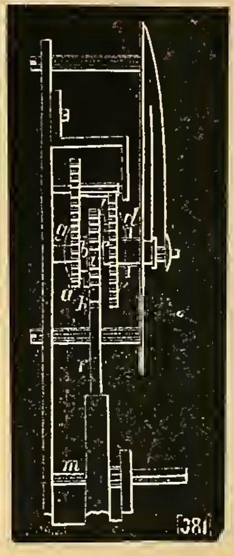
CHAIN DRUM FOR CLOCKS. R. P. No. 18559, K. I. 83. S. Siedle, Furtnangen.



The arrangement consists in the star-wheel s, and ratchet wheel a, being mounted and rivetted on to the pipe h, whereby the star wheel is fixed firmly between the circular shoulder g of the main wheel b, and the ratchet-wheel a.

INDICATOR CLOCKS FOR BILLIARDS. R. P. No. 18322, K. I. 83. C. Oerthing, Neuminster, Holstein.

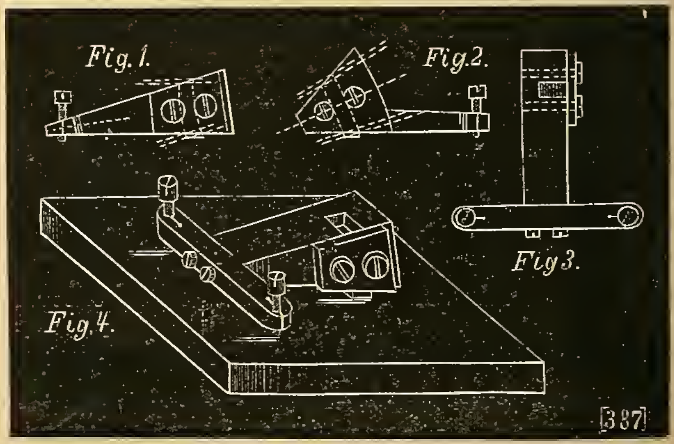
The minute and hour hands are simultaneously set to 12 o'clock, and the 60 minutes by the axle m, and rake r. The idle wheel i carries two clicks, k and l, acting into the ratcheted projections of the cannon and hour-wheel g and e.



The latter turns friction-tight in the hour-wheel d, by the aid of a spring at d. Thus, when the wheel i is moved, both minute and hour hands are set together.

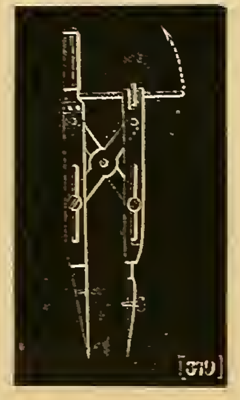
TOOL FOR ADJUSTING AND POLISHING THE IMPULSE PLANES OF INSERTED PALLETS IN THE GRAHAM CLOCK ESCAPEMENT. From the Austro-Hungarian *Uhrmacher Zeitung.*

Circular grooves are turned into pieces of brass corresponding in size and radius to the pallets. Into this groove the pallets are fastened by a steel cover and two screws. The piece (Fig. 1) is used for the engaging pallet, and that shown in Fig. 2 for the disengaging pallet, and are fixed to a crossbar with two adjusting screws (Fig. 3). Fig. 4 shows the whole apparatus, together with the plate glass or polishing block, ready for use.



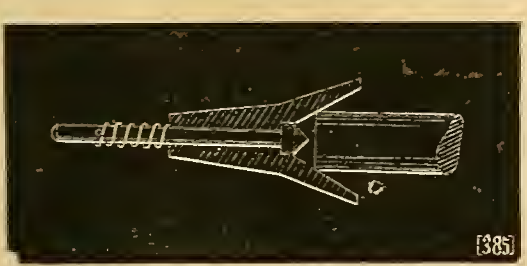
Parallel Compasses. R. P. No. 17918, K. I. Charles Muller, Charleston, South Carolina.

The object of this invention is to obtain a constant vertical position of the compass feet to the plane of the paper, so that in drawing large or small circles, the points of the pen are always on the same level, by which fine sharp lines can be obtained. The illustration shows the relative parts and their action: the principle of construction is given in several modifications, of which the annexed figure represents one.



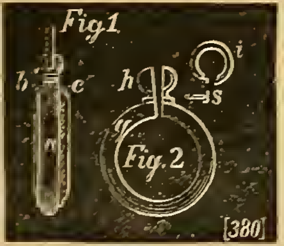
Self-Acting Centreing Tool.

The accompanying illustration is from *The Metalworker* and shows a tool for centreing arbors or wire.



New Form of Watch Case. R. P. No. 18835, K. I. 83. Gustave Speckhart, Nurnberg.

The pillar-plate *a* (Fig. 1), to which the various parts of the watch are attached, has on its front side a groove *b* for the watch glass, and on the back a groove *c* for the cover or dome, in which are the holes for winding and set hands squares. Likewise, plate *a* has the pendant and bow attached. The glass is pressed into the groove *b* and the dome into the groove *c*, and the whole is enclosed in a case of vulcanite.



In a modification (Fig. 2) the pendant *h* is attached to the metal rim *g*, which is cut in the middle, and can be closed by means of the screw *s*. The bow *i* is afterwards sprung in to corresponding champhers in the pendant *h*, and the whole encased in india rubber.

Greenwich Chronometer Trials.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER AND SILVERSMITH."

Sir,—As I supplied you with the figures which appeared last month, in your article on the above subject, I feel it incumbent on me to draw your attention to a few errors which I failed to detect in the proof.

Line 3, page 41, read + 5·5 for + 5·7.
" 5, " " " − 4·2 " + 4·2.
" 6, " " " 7·2 " 6·5.

There is also an error on the next page, in reference to Mr. Kullberg's chronometer, 2·9 should be 2·3; this is clearly borne out by the general tenor of your remarks.

While writing, I would like to say that I dissent from the view advanced in the *Horological Journal*, respecting the disposal of the Clockmakers' prizes, inasmuch as it is assumed that the second prize will be given to the owner of the third chronometer; whereas, Rule 1 distinctly says that the winning chronometers must respectively stand *first* and *second* on the list.

It might be interesting to reproduce Rule 8, which is as follows:—

"No chronometer maker, having obtained a First-class prize, together with the Freedom of the Company, shall be eligible to obtain a similar award; but that circumstance shall not affect his right to compete for the Second-class Prize in subsequent trials; neither shall the holder of the Second-class Prize be debarred for the Superior Prize and Freedom in future years."

According to this rule, Mr. Kullberg takes the second prize, and the first prize is withheld altogether.

The same difficulty appears likely to occur if Mr. Mercer became entitled to the second prize again; and I would respectfully suggest to the Clockmakers' Company, through the medium of your journal, that some modification should be made in their conditions.

Nov. 1*st*, 1882. JAMES U. POOLE.

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Watch and Clockmakers' Pension Society.

The Half-yearly General Meeting of this Society was held at the Horological Institute on Monday, October 30th, the Treasurer, Mr. James U. Poole, occupying the chair.

The deaths of two female pensioners were announced—Mrs. Harris on August 8th, in her 69th year, and Mrs. Griffith on August 29th, in her 86th year; after which the Chairman informed the meeting of the gratifying fact that the Goldsmiths' Company had, upon his personal application, made a grant of £25 to the funds of the Society, which would be paid on November 24th; and that the Merchant Taylors' Company had also forwarded a cheque for £5 5s. He hoped that some of the other companies would manifest equal liberality.

Messrs. Ball, Collins, Jenkins, Pass, Ranstead, Singleton, and Woodhouse, were re-elected Members of the Committee.

During the evening a ballot was taken for the election of a male annuitant, with the following result:—Vickers, 312; Plaskett, 263; Scaife, 184; Tatum, 91; Johnson, 45; the first-named being declared duly elected by the Chairman.

The average age of the five candidates was seventy-three years, sixty being the qualifying age fixed by the rules of the Society.

Votes of thanks were passed to the Scrutineers, the Secretary, the Press, and the Committee (especial mention being made of the kindness of Mr. Newman in allowing the use of his office), and the meeting was brought to a close by a vote of thanks to the Chairman and Treasurer, who, although new to his duties, had given abundant proof that he took a real interest in the Society.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(Continued from page 32.)

As there is not always *Fine Silver* for the standarding of Silver reported *Worse* at hand, the following rules and examples will be of advantage for *mixing* Bullion of various reports to compose standard. For finding the relative proportion of the different qualities, proceed as follows:—

Deduct the fine contents of the Bullion reported *Worse* from standard, and take the difference in parts of the Bullion reported *Better*; then deduct the standard from the fine contents of the Bullion reported *Better* and take the difference in parts of the Bullion reported *Worse*, viz.—

	Fine Contents.	Standard.	Result.
Better 16 dwts.	= 238	222	9 parts of 16 dwts. Better.
Worse 9 ,,	= 213		16 ,, 9 ,, Worse.

When it is intended to mix two qualities of Better to one of Worse, or two of Worse to one of Better, link the respective qualities, and add the two results from the quality linked twice into one sum, viz.—

No. 3. Worse 4 dwts.	= 218.		4 parts of No. 1.
,, 2. Better 12 ,,	= 234.		4 ,, ,, 2.
,, 1. Better 16 ,,	= 238.	16 and 12 =	28 ,, ,, 3.

The same method may be adopted for the mixture of four or five different qualities of Bullion.

For standarding two or more qualities of Bullion of which the quantity of one of the qualities is *given*, proceed as follows: Multiply the number of ounces by the report of the *given* quality, and divide the product by the report of the quality to be added for standarding, viz.: To 90 ounces reported *Worse* 24 dwts., how much of silver reported *Better* 16 dwts. has to be added to bring the mass to Standard?

90 × 24 = 2160 ÷ 16 = 135 ozs. of Better 16 dwts.
To be added to 90 ,, Worse 24 ,,
Make 225 ounces Standard.

When it is intended to add silver of different reports to the Bullion of the *given* weight, divide the given weight into as many parts as there are different qualities to be added, and calculate each division with the report of a different quality, viz.: What quantity of each of the qualities of silver reported 12 dwts. and 16 dwts. Better respectively has to be added to 90 ounces of Bullion reported Worse 24 dwts.?

90 ozs. (45 × 24 = 1080 ÷ 12 = 90 ounces of Better 12 dwts.
(45 × 24 = 1080 ÷ 16 = 67 ozs. 10 dwts. Better 16 dwts.
To be added to 90 ozs. Worse 24 dwts.
Make 247 ozs. 10 dwts. Standard.

Gold Bullion *above* Standard is invariably reported Better, and the small per centage of silver contained therein is not taken into account, the value of the Bullion being determined by the quantity of Standard of 22 carats fine contained therein.

The following table will show the quantity of Standard contained in an ounce as well as in a dwt. of any report *Better* than Standard.

	Car.	Gr.	¼gr.		Oz.	Dwt.	Gr.		Dwt.	Gr.
1 oz. of Bullion, reported *Better*	0	0	1	cont. Stand.	1	0	1 4/11	1 dwt. cont. ..	1	0 3/44
1 ,, ,, ,,	0	0	2	,,	1	0	2 8/11	1 ,, ...	1	0 6/44
1 ,, ,, ,,	0	0	3	,,	1	0	4 1/11	1 ,, ...	1	0 9/44
1 ,, ,, ,,	0	1	0	,,	1	0	5 5/11	1 ,, ...	1	0 12/44
1 ,, ,, ,,	0	1	1	,,	1	0	6 9/11	1 ,, ...	1	0 15/44
1 ,, ,, ,,	0	1	2	,,	1	0	8 2/11	1 ,, ...	1	0 18/44
1 ,, ,, ,,	0	1	3	,,	1	0	9 6/11	1 ,, ...	1	0 21/44
1 ,, ,, ,,	0	2	0	,,	1	0	10 10/11	1 ,, ...	1	0 24/44
1 ,, ,, ,,	0	2	1	,,	1	0	12 3/11	1 ,, ...	1	0 27/44
1 ,, ,, ,,	0	2	2	,,	1	0	13 7/11	1 ,, ...	1	0 30/44
1 ,, ,, ,,	0	2	3	,,	1	0	15 —	1 ,, ...	1	0 33/44
1 ,, ,, ,,	0	3	0	,,	1	0	16 4/11	1 ,, ...	1	0 36/44
1 ,, ,, ,,	0	3	1	,,	1	0	17 8/11	1 ,, ...	1	0 39/44
1 ,, ,, ,,	0	3	2	,,	1	0	19 1/11	1 ,, ...	1	0 42/44
1 ,, ,, ,,	0	3	3	,,	1	0	20 5/11	1 ,, ...	1	1 1/44
1 ,, ,, ,,	1	0	0	,,	1	0	21 9/11	1 ,, ...	1	1 4/44
1 ,, ,, ,,	1	0	1	,,	1	0	23 2/11	1 ,, ...	1	1 7/44
1 ,, ,, ,,	1	0	2	,,	1	1	0 6/11	1 ,, ...	1	1 10/44
1 ,, ,, ,,	1	0	3	,,	1	1	1 10/11	1 ,, ...	1	1 13/44
1 ,, ,, ,,	1	1	0	,,	1	1	3 3/11	1 ,, ...	1	1 16/44
1 ,, ,, ,,	1	1	1	,,	1	1	4 7/11	1 ,, ...	1	1 19/44
1 ,, ,, ,,	1	1	2	,,	1	1	6 —	1 ,, ...	1	1 22/44
1 ,, ,, ,,	1	1	3	,,	1	1	7 4/	1 ,, ...	1	1 25/44
1 ,, ,, ,,	1	2	0	,,	1	1	8 8/	1 ,, ...	1	1 28/44
1 ,, ,, ,,	1	2	1	,,	1	1	10 1/11	1 ,, ...	1	1 31/44
1 ,, ,, ,,	1	2	2	,,	1	1	11 5/11	1 ,, ...	1	1 34/44
1 ,, ,, ,,	1	2	3	,,	1	1	12 9/11	1 ,, ...	1	1 37/44
1 ,, ,, ,,	1	3	0	,,	1	1	14 2/11	1 ,, ...	1	1 40/44
1 ,, ,, ,,	1	3	1	,,	1	1	15 6/11	1 ,, ...	1	1 43/44
1 ,, ,, ,,	1	8	2	,,	1	1	16 10/11	1 ,, ...	1	2 2/44
1 ,, ,, ,,	1	3	3	,,	1	1	18 3/11	1 ,, ...	1	2 5/44
1 ,, ,, ,,	2	0	0	,,	1	1	19 7/11	1 ,, ...	1	2 8/44

The value per oz. of Standard Gold is £3 17s. 9d.
,, ,, dwt. ,, ,, £0 3s. 10½d.
,, ,, grain. ,, ,, £0 0s. 1¾d.

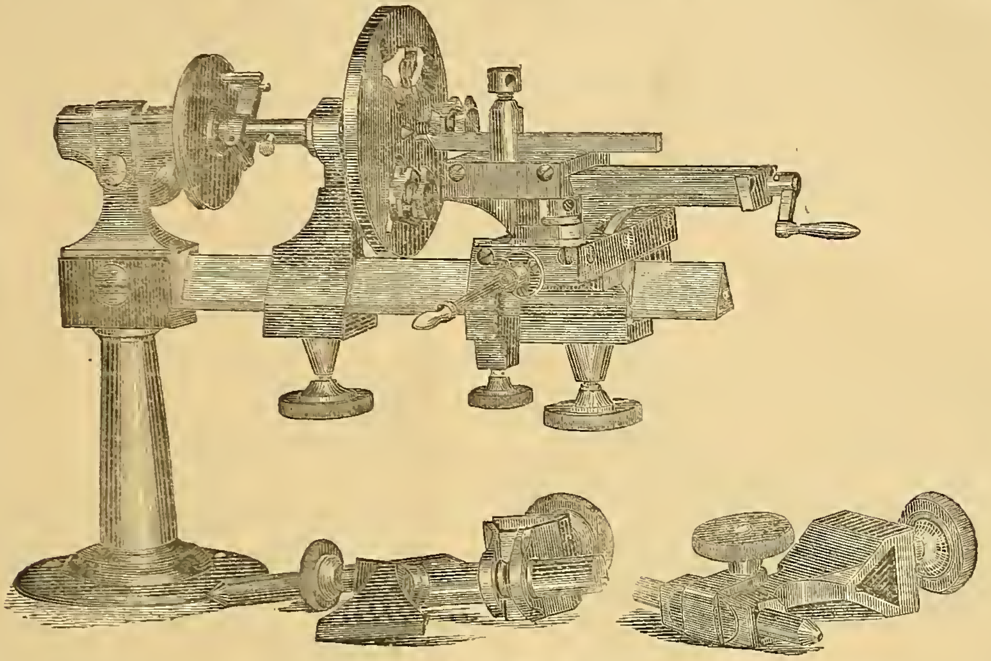
Gold Bullion *below* Standard should be reported as a "Parting Assay," specifying the quantity of Fine Gold and Fine Silver in twelve ounces, or the pound troy, as the Silver contained therein often forms an important part of the value thereof.

Value of Fine Gold.		£	s.	d.
Per ounce	..	4	5	0
Per dwt.	..	0	4	3
Per grain	..	0	0	2⅛

Value of Fine Silver.		s.	d.
Per ounce	..	5	0
Per dwt.	..	0	3
Per grain	..	0	0⅛

Watchmakers' Tools.

LATHE WITH LUNETTE AND PLATFORM WITH THREE CLAWS AND CARRIAGE. CAN BE USED AS A UNIVERSAL LATHE.



Nos. 1, 2, 22, 23, 26, 27.

Having placed the centreing rod to its place in the arbor, you then screw the platform on the arbor. The claws are so constructed that plates as large as 22 lig. can be placed on the lathe (which is 50 mm. high) and to make easily every opening on it.

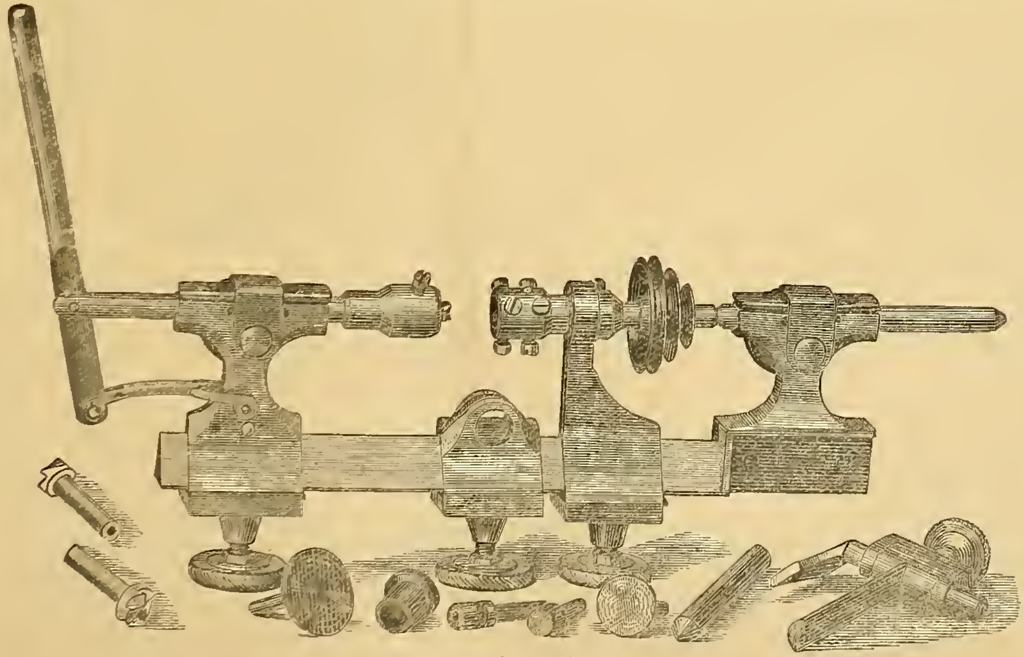
The carriage-support is so constructed that one can use it to turn flat as well as lengthwise. The part that has the graver is moveable, enabling one to turn conical things; therefore, this carriage offers a great advantage over that of the ordinary universal lathe, since it admits of turning with greater accuracy, and in very short time, all kinds of axes, barrel-arbors, pinions, screws, &c. Every shop would be benefitted by the acquisition of such a tool. It is made for all sizes of lathes.

FOOT OR SUPPORT FOR LATHE.

As there are workmen who do not like to place the lathe to the vice, a support is made which can be screwed on the bench. It assists to raise or lower the lathe, and at the same time to turn it horizontally. They are made of iron or of bronze.

LATHE WITH THE FOLLOWING ACCESSORIES:

No. 2. Lunette, with four Chucks. No. 11. Drilling accessories, with lever and plate. No. 12. Countersinking accessories with one head and six countersinks. No. 3. Fastening Chuck, armed with eight steel-screws.



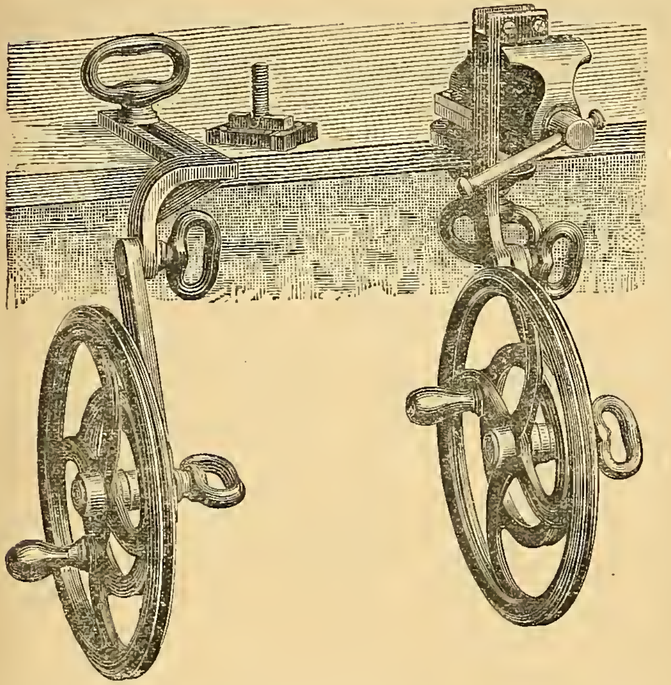
Nos. 1, 2, 3, 11, 12.

No. 2.—*The Lunette* is made of bronze, with hard steel jointing inside, in which the arbor revolves. The arbor is made of hardened cast-steel, and is provided with a dragging piece: The pulley moving the arbor can slide on the rod, so that the tension of the string has no influence on the pivot of the arbor. Besides a drill-holder, the arbor has three chucks on which to cement pieces.

No. 11.—*The Drilling Apparatus* is fastened on the lathe by means of a pin with an eye. By means of the lever, the rod carrying the plate is brought in contact with the drill fixed in the lunette arbor. This way of drilling straight is more expeditious than it is with the ordinary drilling tool.

No. 12.—*The Countersinking Accessory.* To countersink one has to take off the drilling plate and replace it with the countersink-holder. In place of the drill-box, you set the rod of steel or brass you want to mill, having first made the end of the rod a little tapered; you then press the lever in the same way as above, putting a little oil to the rod. In this manner screws, axes, centre-posts, &c., can be made very quickly and very nicely. There are generally six countersinks to each lathe, but a larger number can be added agreeably to the wish of the constituent. Countersinks and centres can be furnished without need of sending any part of the lathe.

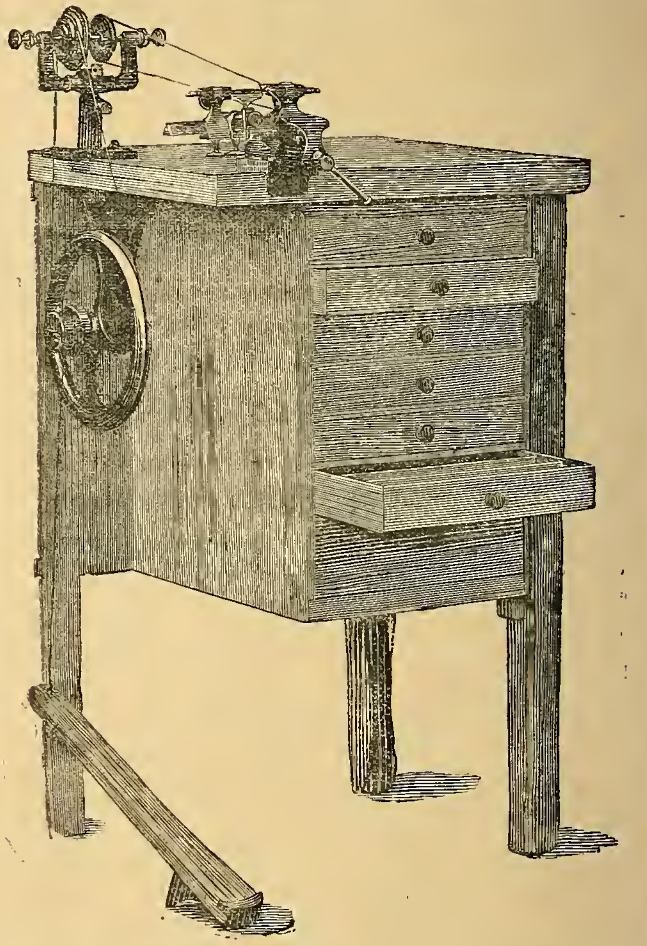
HAND-WHEEL.



This little wheel is double; one of the circles measures 225 mm., and the other 130 mm. in diameter. It revolves on a steel pivot fixed in a sort of arm to be fastened to the vice; the end of that arm has a slot, in which can be placed the lathe by means of two screws. That same arm is also divided in two by way of a knuckle joint, enabling one to change the position of the wheel at will.

Another kind of arm is also made, which can be placed under the bench, next to the vice. The horizontal arm, in this case, has a long slot, with which to draw the wheel in the back of the under bench, or even to remove it entirely, when the work is finished. For this sort of wheel there is no necessity of having a returning wheel.

WORKING-TABLE CUT TROUGH, SHOWING THE WHEEL, RENVOI, PEDAL, AND STRINGS.



It is advisable to use thick strings, which produce enough friction on the rolls, without straining them too much. The returning wheel must be, as far as possible, remote from the vice.

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Iron Cement for High Temperatures.—(1) Iron filings, 20 parts; lime powder, 45; borax, 5; common salt, 5; permanganate of potash, 10. The borax and the salts are dissolved in water, and are then mixed with the two first-named ingredients as quickly as possible and used. This cement changes at a white heat to a glassy mass, which is perfectly air-proof. (2) Permanganate, 25 parts; zinc white, 25; borax, 5. These are treated with a solution of soluble glass, and used at once. This cement must be left to dry slowly, and then it will resist the highest temperatures.

Cement for Gas Retorts.—For cementing earthenware gas retorts, which have to withstand very high temperatures, the following cement can be used: Powdered glass, 5 parts; chamotte meal, 5; powdered borax, 1. Chamotte meal is obtained by pulverising broken pieces of gas retorts. This cement is a hard glass, which only melts at the highest temperatures, and then closes the leaks in the retort. To render the iron retort cover which closes the retort air-tight, a cement is used, consisting of schwerspath powder, to which as much soluble glass has been mixed as to obtain a paste of sufficient strength.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

XLI.

Extraction of Copper Salts.—Collect all the liquids holding copper in a large cask filled with wrought or cast-iron scraps; a chemical reaction immediately takes place, the iron is substituted for the copper to make a soluble salt, and copper falls to the bottom of the cask in the shape of a brown powder. The cask should be large enough to hold all the liquids employed in a day's work. The iron scrap should be suspended in willow baskets on the top of the liquor, and by stirring now and then the liquid with them, the metallic powder of copper will alone fall to the bottom of the cask. The same method may be employed for recovering the copper from old cleansing acids, or from old worn out galvanoplastic baths. The copper thus obtained is quite pure; calcining it in contact with the air gives a black binoxide of copper for neutralizing too acid galvanoplastic baths.

Ashes.—Sweepings, saw-dust, residues from the bottoms of scratch-brushing tubs, filters, papers and rags, must be collected, mixed, and burned in a furnace constructed for the purpose. The ashes are finely pulverized, sifted, and thoroughly mixed with a quantity of mercury, which combines with the gold and silver. The amalgams, separated by washing, are then distilled in cast-iron retorts of a peculiar shape; the mercury volatilizes, and the gold and silver remain in the retort. For separating these metals, granulate the solid mass, and treat with pure nitric acid, which dissolves the silver and is without action upon the gold. The latter metal collects at the bottom of the vessel in a black or violet powder, and is pure, after having been soaked in distilled water. If an ingot contains only a little silver and much gold, melt previously with a certain proportion of the former metal, in order to more easily dissolve in nitric acid. The ingots of silver and copper should be boiled in cast-iron kettles with concentrated sulphuric acid, which transforms the copper into soluble sulphate of copper, and silver into sulphate of silver, only slightly soluble. The separation of the two may be partly effected by washing, but generally the silver is precipitated by plates of copper. The alloy, previous to its solution, should be granulated.

Galvanoplasm.—Thick Deposits.—Galvanoplasm consists of deposits with sufficient thickness to form a resisting body, which may be separated from the objects serving as moulds, and which will preserve the shape and dimensions of the model. A statue of plaster of Paris, wood sculpture, an impress in wax, fruit, and similar things, may, after certain preparations, be covered with electro-deposits, for instance, which will give a deposit representing the same shape and dimensions. In galvanoplastic operations copper is almost exclusively employed. It is possible to have the deposits entirely of silver and gold; but these are exceptions, on account of the cost of the materials and of the difficulties of the operation. The following is a summary of the usual requirements:—(1.) To apply upon a metallic surface conductor of electricity, a deposit of copper adhering to the metal underneath. (2.) The above operation being completed, the two metals must be separated in such a manner that they will furnish two identical productions, one of which will be in relief and the other hollow, for casts of medals, &c. (3.) To apply the electro-deposits upon substances not naturally conductors of electricity, but rendered so by the process of metallization; upon ornaments of plaster of Paris, wax, glass, or porcelain; or upon leaves, fruits, and insects. (4.) After the deposit to separate the non-metallic model, to have a perfect copper copy of it. For reproduction of type in stearine, gutta-percha, gelatine. (5.) Or if it is impossible to apply the electro-deposit of copper directly upon the model, make moulds upon which a greater or less number of copies may be obtained. This is the general case: The imprint of the model is taken with a plastic substance, which is rendered a conductor of electricity, and upon which the galvanoplastic deposit is effected.

The Baths.—(1.) Put into a vessel made of glass, stoneware, porcelain, gutta-percha or lead, a certain quantity of water, to which is added from 8 to 10 per cent. of sulphuric acid. If, in a glass vessel, or one lined with gutta-percha, pour in the acid slowly and stir all the time; otherwise the acid, which is much denser than water, falls to the bottom, and, slowly combining with the surrounding water, may cause an increase of temperature sufficient to break the glass or melt the gutta-percha. (2.) Dissolve in this liquor as much sulphate of copper as it will absorb at the ordinary temperature; stir frequently with a glass or wooden rod, to mix the solution; or the sulphate of copper may be put into a perforated ladle of copper or stoneware, or into a bag of cloth fixed near the surface of the liquid. When the liquid refuses to absorb any more crystals it is saturated, and marks about 25° of Baumé's hydrometer. Baths of sulphate of copper, while they are working, must always be kept saturated. New sulphate of copper must be introduced to replace that decomposed and forming the metallic deposit; for this purpose suspend to the top of the vessel, and in the upper portion of the liquid, bags always filled with crystals of sulphate of copper. It is necessary to use good sulphate of copper; the best is in crystals, semi-transparent, and of a fine blue colour. Its solution is also a pure blue. These baths are always used old, and are kept in vessels of shapes adapted to the wants of the operator. Stoneware, porcelain, and glass are the best materials for the purpose; but as it is difficult to find vessels sufficiently large, wooden troughs covered inside with coats of gutta-percha, marine glue, or sheet lead, are used, painted with resist varnish.

Deposits by Separate Batteries.—After proper preliminary operations, the object which is to receive the deposit is connected with the conducting wire attached to the negative pole of the battery—zinc generally, and immersed in the solution; and the conducting wire starting from the positive pole, carbon or copper, is attached to a foil or plate of copper, and this anode is placed in the liquor parallel to the object connected with the other pole. This plate should have a surface at least equal to that of the article to be covered. The deposit will begin immediately, and its progress may be seen by removing the object from the solution. If, upon a clean metallic substance, the deposit of copper will be instantaneous on every part of it; if, on the contrary, the surface only moderately conducts the electricity, as plumbago or graphite, the deposits will begin at the points touched by the conducting wire, and then proceed forward. With a little practice it is easy to ascertain whether the intensity of the current corresponds to the surfaces to be covered. The operation will be slow with a weak current, but there is no other inconvenience, unless the substance of the mould is alterable, like gelatine. Too intense a current results in a granular deposit, of which the particles have little cohesion between themselves, and no adherence to the mould.

(To be continued.)

Trade Notes.

John Sinclair, 51, jeweller, was charged with stealing a gold Albert chain, two diamond rings, a sapphire ring, and other similar articles, the property of Mr. Culver, a manufacturing jeweller, carrying on business in Clerkenwell. Mr. F. H. Lewis prosecuted, and Mr. Purcell defended. The prisoner, it will be recollected, was observed by Davison, a City constable, in Ludgate Hill, who watched him enter the shop of Mr. Avant, a pawnbroker, in Fleet Street. While he was endeavouring to pawn some jewellery the constable went in, and after putting some questions to him took him into custody. He found that he was in possession of a large quantity of valuable jewellery, and the sum of £125 in bank notes and gold. The result of inquiries subsequently made led to the discovery that nearly the whole of the jewellery had been stolen from the warehouse of the prosecutor, which the prisoner was in the habit of attending, and where he had occasionally made some small purchases. The jury found the prisoner guilty, and as it was proved that he had been twice previously convicted of felony and sentenced to five and seven years' penal servitude, he was on this occasion sentenced to twelve years' penal servitude.

The Lord Mayor, accompanied by the Lady Mayoress, and attended by the principal officers of the Corporation, visited in state, the other afternoon, the diamond-cutting works of Messrs. Ford and Son, Clerkenwell Green. The Baroness Burdett-Coutts with Mr. Burdett-Coutts and a distinguished company, were also present. Amongst other objects of interest shown were the massive diamond discovered in the Kimberley mines, belonging to Mr. P. Rhodes, weighing 150 carats, and valued at half a million sterling; also the Indian diamond Gor-do-Noor, weighing 67 2-8 carats, and valued at £36,000, the property of Messrs. P. Orr and Co., goldsmiths, Madras.

A large new church clock has just been erected in Oaksey church, Wiltshire. It is fitted with all the latest improvements, strikes the hours and half-hours, and shows time upon two five-feet dials. A similar clock has also been put in the neighbouring church of Crudwell, which has one five-feet dial. The striking of this clock has been heard three miles away. Both clocks have been erected by Messrs. Smith, Midland Clock Works, Derby.

Numerous applications having reached us as to where Boley's tools can be procured in England, we take this method of informing our readers and the trade generally, that J. J. Stockall, 6 and 8, Clerkenwell Road, London, E.C., is agent for the same, where all information can be obtained.

Messrs. B. H. Joseph & Co., of 20, Frederick Street, Birmingham, have patented a very valuable article much wanted in the trade, and one that is both simple and ingenious. It is a size for measuring the arm for bracelets. Hitherto there has not been anything of the sort used in the trade, and it must prove of great benefit. It is called the "Standard" bracelet sizer. The patent is applicable to measuring for other purposes as well.

Ingenious Robbery of Diamonds.

The details have transpired of a most daring and ingenious robbery of diamonds, valued at between £400 and £500, belonging to Messrs. Wellby, 18 and 20 Garrick Street, Covent Garden, and it is believed that with the capture of the thief further discoveries in relation to other jewel robberies will be brought to light. It appears that Mr. George Attenborough, who has recently removed his stock from his shop, now undergoing demolition, at the corner of Chancery Lane, to his new premises at 71, Strand, was conversing one day with some customers, when a stranger hurriedly entered and asked whether any one of the name of Hamilton had come about the purchase of some jewellery. Mr. Attenborough turned to the new comer, and, seeing he was quite unknown to him, asked the hour at which he was to meet Mr. Hamilton, and the nature of his business, to which questions he gave satisfactory replies, and depositing his hat on the counter, he quitted the shop as if to give directions to the cabman who had driven him there. He was observed by an assistant to be in conversation outside with another man, who handed to him a small black bag, with which he entered the shop, and stood near the door, as though awaiting the arrival of his friend. No one, however, came, and presently he put on his hat and went away, saying he would return again shortly. No one of the name of Hamilton called, and nothing more was seen of the visitor during the rest of the day, and on Friday Mr. Attenborough asked his assistants whether they had heard or seen anything of their strange visitor. He was told that he had not returned, and a curious fact connected with his visit was that one of the assistants felt confident that the man he was talking to outside the shop was one of Messrs. Wellby's people. The whole circumstances were so strange, that a member of Mr. Attenborough's staff took an opportunity of calling at Messrs. Wellby's on Saturday morning, and during his visit he mentioned that he had seen one of their people outside Mr. Attenborough's premises on Thursday. "Why, of course you did," was the reply, "he took down the jewellery you sent for." "We have sent for no jewellery," said Mr. Attenborough's assistant, and immediately the nature of the fraud became apparent. It was afterwards discovered that on the day previous to the robbery a well-dressed man called on Messrs. Hancock, and stated that he came from Messrs. Attenborough, whose card he presented, and said they had just entered their new premises, and wished for some handsome jewellery for stock. Messrs. Hancock's manager replied that he thought it very odd that Mr. Attenborough should send to him, as he (Mr. Attenborough) could buy jewellery much more suited to him at Messrs. Wellby's, with whom he knew Mr. Attenborough dealt; and he added, "You tell him so with my compliments." The next day the thief, fortified with Messrs. Hancock's advice, called on Messrs. Wellby, and stated that he was an assistant to Messrs. Attenborough, and had been sent for some expensive diamond ornaments to show a customer at their new shop in the Strand. The first observation was, "Why, you are not one of Messrs. Attenborough's assistants." To which he replied, "I have been there for years; here is our card." And he again produced the card he had previously procured. Messrs. Wellby than allowed him to select £400 or £500 worth of brilliants, handsomely set; and not being quite satisfied with his statement, sent one of their assistants with him in a cab to Mr. Attenborough's. The thief alighted first, and asking the young man to wait a moment while he spoke to Mr. Attenborough, he entered the shop as described above. The assistant to Messrs. Wellby paid off the cab, and was following the stranger into the shop when that

person ran out without his hat saying, "All right, the customer happens to be there now. Give me the bag." He then took the bag and ran into the shop. Mr. Wellby's man, after looking through the glass and seeing the stranger inside with several of the regular assistants, became satisfied that all was right, and walked away. So, it appears, did the thief, carrying the jewels with him. He is described by the attendants at Messrs. Wellby's as follows:—Height, 5ft. 8in. or 5ft. 9in.; oval face, pale; dark hair, inclined to grey; whiskers and slight moustache and beard; age about 45; wearing black frock coat and silk hat. The stolen bracelet contained a single row of diamonds; one of the brooches was arranged in the shape of a leaf, the other in the form of a spray. The earrings were rather long and old-fashioned, of the description known as "drop earrings."
—*Pawnbrokers' Gazette.*

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 50.)

Bronze work of the sixteenth century is less abundant in other parts of Germany; we must not, however, overlook the City of Lübeck, where, in the Marienkirche, is a bronze font of the fourteenth century, and where others exist of later date. That in the Egidien Kirche of 1454 is a simple bronze basin on stone lions. One of Gothic character is in the cathedral, by Laurens Groven, in 1455, with statuettes in arched recesses. Other fonts of bronze are in churches, as one at Stendal, of 1474, in the Marienkirche; another of 1520, and a lattice-work at Salzwedel by Hanz von Köln; at Emmerich is another supported by sirens. At Erfurt, in the cathedral, are numerous monumental slabs commemorating canons and other dignitaries; these are mostly engraved, and rather to be classed among brasses, some only of more recent date being in relief. In the latter half of the sixteenth century German sculpture in bronze is less abundant and remarkable, and becomes more and more subjected to the influence of the followers of Michael Angelo. Some grand works were, nevertheless, executed at Nuremberg and elsewhere.

In northern Germany the use of bronze memorial slabs was still, though not abundantly, continued; several of them may have emanated from the Nuremberg foundries. Of such probably are those at Coburg. A bronze tablet to Christina, landgravine of Hessen (died 1549), is at Cassel, in the Church of St. Martin. One is in the Cathedral of Magdeburg, to Ludwig von Lochow (died 1616); and again another to Cuno, who died in 1623, with his portrait, and the subject of the entombment treated in a highly finished *baroque* style.

During the latter half of the seventeenth and the earlier years of the eighteenth centuries works of sculpture in bronze were but rarely executed in Germany; the thirty years' war too much engrossed the attention of all classes. Notwithstanding, some excellent artists of the Flemish, Netherland, and Dutch schools, worked at Berlin and elsewhere. In 1697 Andreas Schluter, a native of Hamburg, who had studied his art in the low countries, modelled the statue of the elector Frederick III., which was cast by Jakobi, and erected in Königsberg. He afterwards modelled the equestrian statue to the great Elector which is on the bridge at Berlin; this also was cast by Jakobi in 1700 and erected in 1703, and is a work of the highest excellence. At the angles of the pedestal, which is panelled with bas-relief, are figures of captives in their chains. At Vienna George Raphael Donner (1692-1741) modelled figures of the rivers of Austria, and of Providence, which were cast in lead and now adorn the fountain in the new market-place in that city.

As the *barocco* of Louis XIV. had guided taste in Germany previous to the great revolution, so the cold pseudo-classical style of the Republic and the Empire afterwards spread its chilling influence, aided by the example of Canova and of David. From the extravagance of the former manner artists were led by archæological teaching, and by studying the then recently discovered monuments of Grecian art, to adopt a method which was but a petrifaction of their characteristics, or a lifeless reproduction of their forms. The genius of Flaxman, and yet more, that of Thorwaldsen (whose most important work in bronze is the equestrian statue of the Elector, Maximilian I. at Munich) barely succeeded in rescuing the plastic art of their respective countries, and of Germany, from this scholastic rigidity; while France and Italy resigned themselves to the trammels of their own newly-created manner. A more naturalistic and healthy sentiment has since everywhere prevailed.

(*To be continued*).

F. Kosch, of Vienna, has patented a process for obtaining coloured deposits on metals by melting, for which he uses silver precipitated by means of sulphate of iron, and gold precipitated by sulphate of iron; the oxides of iron, cobalt, nickel, chrome, manganese, and copper; the arseniates and phosphates of iron, nickel, copper, and cobalt. The composition for black consists of equal parts of sulphate of oxide of cobalt and sulphate of suboxide of manganese, which are melted together, with five times their weight of nitrate of potash. The whole is softened in hot water, then thoroughly washed with water and dried. The melting composition is prepared by mixing 24 parts minium orange and 9 parts pure boric acid. The mixture is melted till it takes the appearance of clear glass, then poured out, powdered, mixed with water, and dried. The different mixtures for obtaining coloured deposits on metal by the process are prepared as follows—Grey: 3 parts oxide of nickel, 1 part silver (precipitated with sulphate of iron), and 7 parts of the melting composition given above, are finely rubbed on a glass plate after being mixed with distilled water, and spread by means of a brush in a thin layer on the metal which has to be covered. When dry the metal is exposed to a red heat, either on an open fire (gas or coal) or in a muffle. Black: 10 parts composition for black given above, 30 parts melting composition given above. The operation is the same as for grey, and is the same also for the following colours—Green: 7 parts oxide of chrome and 10 parts melting composition. Light green: 12 parts phosphate of oxide of nickel and 20 parts melting composition. Red-brown: 7 parts oxide of iron and 12 parts melting composition. Purpurine red: 4 parts sub-oxide of copper and 10 parts melting composition. Gold and silver, used for decoration by this process are precipitated by means of sulphate of iron. The mixture is, for gold: 48 parts gold, 2 parts silver, and 4 parts melting composition. Silver: 48 parts silver and 7 parts melting composition. Gold and silver are rubbed with oil of turpentine and spread in a thin layer over the metal, and exposed to a low red heat on an open fire or in a muffle.

A List of Watches, Watch Movements, Clocks, &c.

The Property of the Worshipful Clockmakers' Company, and Deposited in the Guildhall, London.

(Concluded from page 52.)

Smith, John, London.

173. Jewelled Repeating Movement, enamelled dial, No. 8499. (In a very good state of preservation).
Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Smith, Joseph, Bristol.

174. Vertical Movement, silver cap and cock, No. 300.
Presented by B. L. Vulliamy.

Spencer & Perkins, London.

175. Pedometer, late the property Her Majesty Queen Charlotte.
Presented by B. L. Vulliamy, 1849.

Sully, Henricus, invenit et fecit (1724), Horologer to the Duke of Orleans.

176. A Spring Clock, of novel construction, showing seconds and days of the month; the action of the balance being combined with an adjustable lever acting vertically thereon.

Fully described in his work, entitled, "Description Abrégée d'une Horloge d'une Nouvelle Invention pour la Juste Mesure du Temps sur Mer, avec le Jugement de l'Académie Royale des Sciences sur cette Invention." Published 1726.
Presented by John Thwaites, Master 1821.

Swaan, Pieter, Amsterdam.

177. A Plain Vertical Movement, with elaborate chased and engraved pillars, enamel dial. A very ancient specimen, No. 620.
Presented by Edward Streeter, 1875.

Taylor, Thomas, London,

Made Free of the Company, 10th August, 1646.

178 Plain Vertical Movement, catgut, with beautifully pierced steel studs and cock.
Presented by B. L. Vulliamy, 1816.

Thomas, John, London.

179. Vertical Movement, with enamel dial, square pillars, in silver pair of cases, No. 6029.
Presented by Deputy S. E. Atkins, Clerk of the Company, 1875.

Tomlinson, William, London.

Served the Office of Warden in 1730; chosen Master of the Company, 29th September, 1733.

180. Vertical Movement, enamel dial, No. 1427.
Presented by Messrs. F. B. Adams & Sons, 1848.

Tompion, Thomas, London.

A celebrated watchmaker. Made Free 4th September, 1671; elected on the Court of the Company 7th September, 1691; served the office of Warden 1700-1703; chosen Master 29th September, 1704; died 13th November, 1713; aged 75; buried in Westminster Abbey. Tompion made a watch with a spiral balance, or pendulum spring, for King Charles II. One end of the spring was made fast to the arbor of the balance wheel, whilst the other was secured to the plate, and the oscillations were rendered equal and regular by its elastic force. He also invented the cylinder escapement, with horizontal wheel, in 1695.

181. Thick Verge Movement, with enamel dial. No. 2926.

182. Plain Verge Movement, no dial. No. 598.
Presented by B. L. Vulliamy, Esq., 1849.

183. Plain Vertical Movement, no dial, No. 2268.
Presented by Edward Streeter, 1875.

Tompion T., and Banger, E., London.

Apprenticed to Charles Kempe, 2nd April, 1694; made Free of the Company, 7th December, 1702. Banger, Apprenticed to Joseph Ashby, for Thomas Tompion, 27th September, 1687; made Free of the Company, 1694.

184. Repeating Clock Movement, with Bell, No. 191. A curious specimen.

Torndo, Francis, Gray's Inn.

Made Free of the Company, 1st April, 1633. His Widow became a Pensioner in 1690.

185. Silver Oval Hunting Watch, silver dial, hour hand only, catgut, no pendant, with raised pins at each hour for feeling the time at night. Called a "Touch Watch."
Presented by Wm. Plumley, Jun., 1817.

Toulmin, Samuel, Strand, London.

186. Centre Seconds, Horizontal Movement, jewelled, No. 3361, enamel dial. There is a wheel on the cylinder which communicates with a pinion, fixed on the balance, which is under the dial, the escape wheel and cylinder being under the cock, beats full seconds. A very curious specimen.
Presented by B. L. Vulliamy, 1830.

Watts, Brounker, London.

Apprenticed to Joseph Knible, 19th January, 1684; made Free of the Company, 5th February, 1693.

187. An Old Bell Repeating Watch, with a highly-finished coloured gold dial; has a peculiar engraved and gilt cap. The case pierced and beautifully engraved, and in good preservation (outer case wanting).

Presented by B. L. Vulliamy, 1816.

Webster, Robert, London.

188. Silver Bell Repeater, with silver dial, open engraved case, with crest—a lion rampant crowned.
Purchased by the Company 1852.

Windmills, Thomas, London.

Apprenticed to Joseph Windmills, 17th January, 1686; made free of the Company 20th January, 1695; chosen on the Court of Assistants 6th July, 1713; served the office of Warden, 1717; chosen Master 1719.

189. Repeating Movement; has an engraved arm and gilt rim.
Presented by Messrs. F. B. Adams & Sons, 1848.

190. Vertical Movement, enamel dial, No. 8736.
Presented by F. Putley, 1817.

Wolverstone,, Benjamin, Londoni.

Apprenticed to R. Richards, 26th May, 1649; made free of the Company, 24th March, 1657.

191. Curious Alarm Watch, silver dial, hour hand only; boxcuriously pierced and engraved, case handsomely studded.

Wrigg, Johannes, in Covent Garden.

One of this name made Free of the Company 4th Nov., 1661.

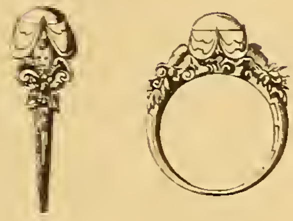
192. A Fragment.

Yeatman, Andrew.

193. Silver Verge Watch.
Presented by Joseph Fenn, 1862.

Supplement to the Watchmaker, Jeweller, and Silversmith, November 6, 1882.

MONTHLY SUPPLEMENT OF DESIGNS.



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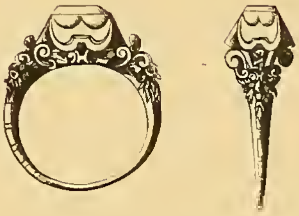

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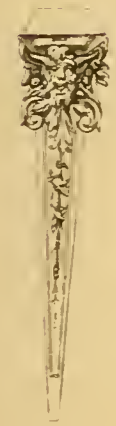

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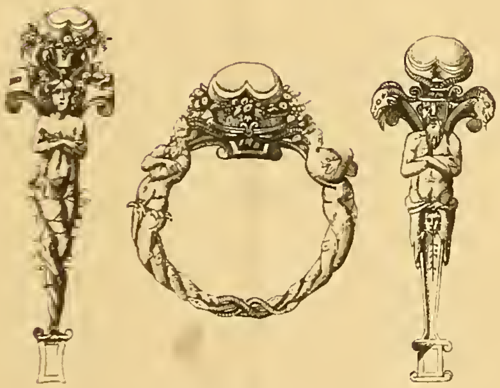

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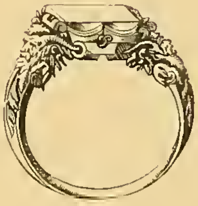

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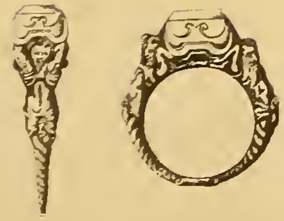

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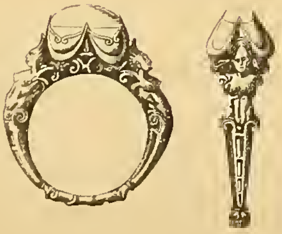

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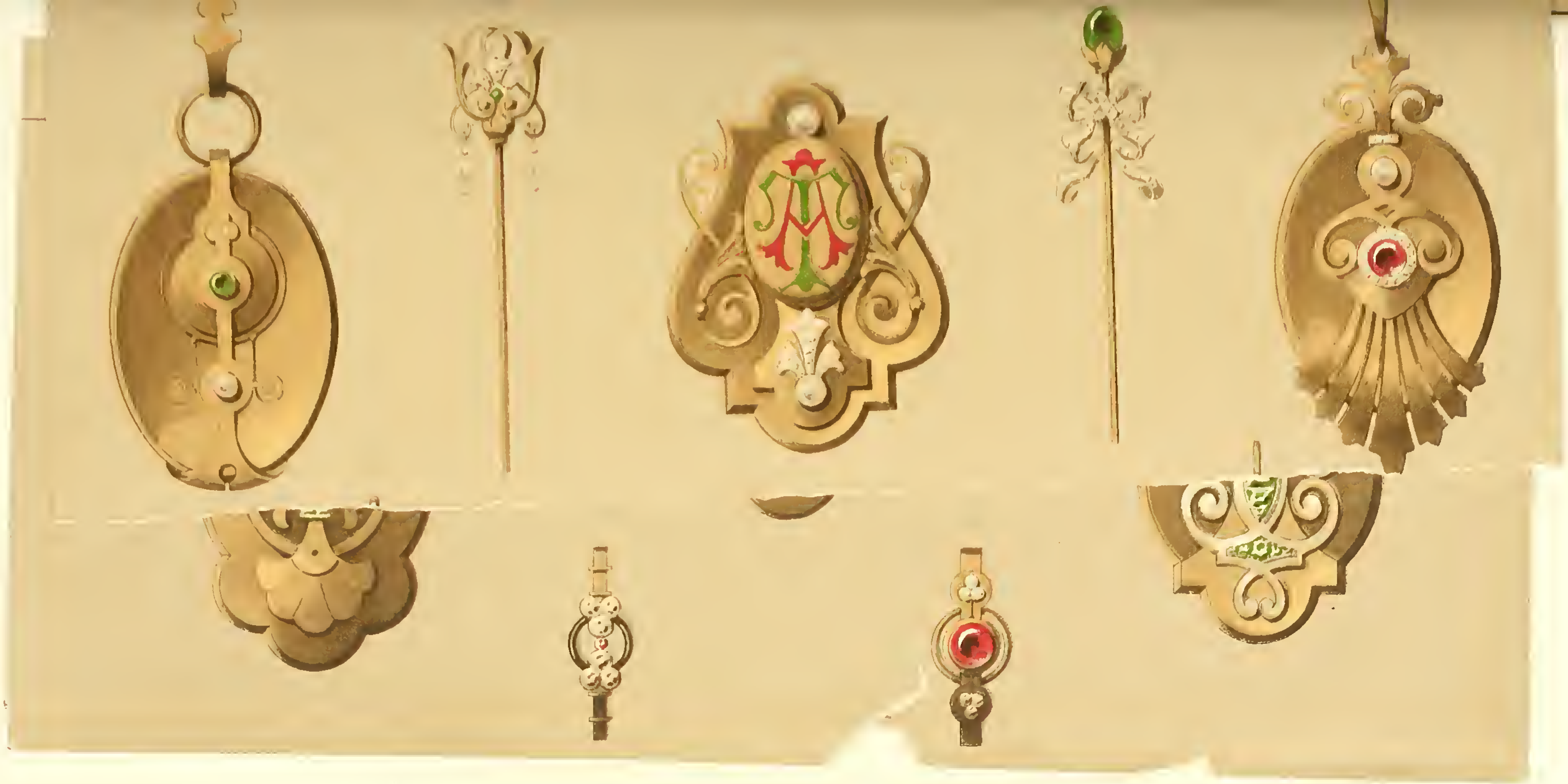

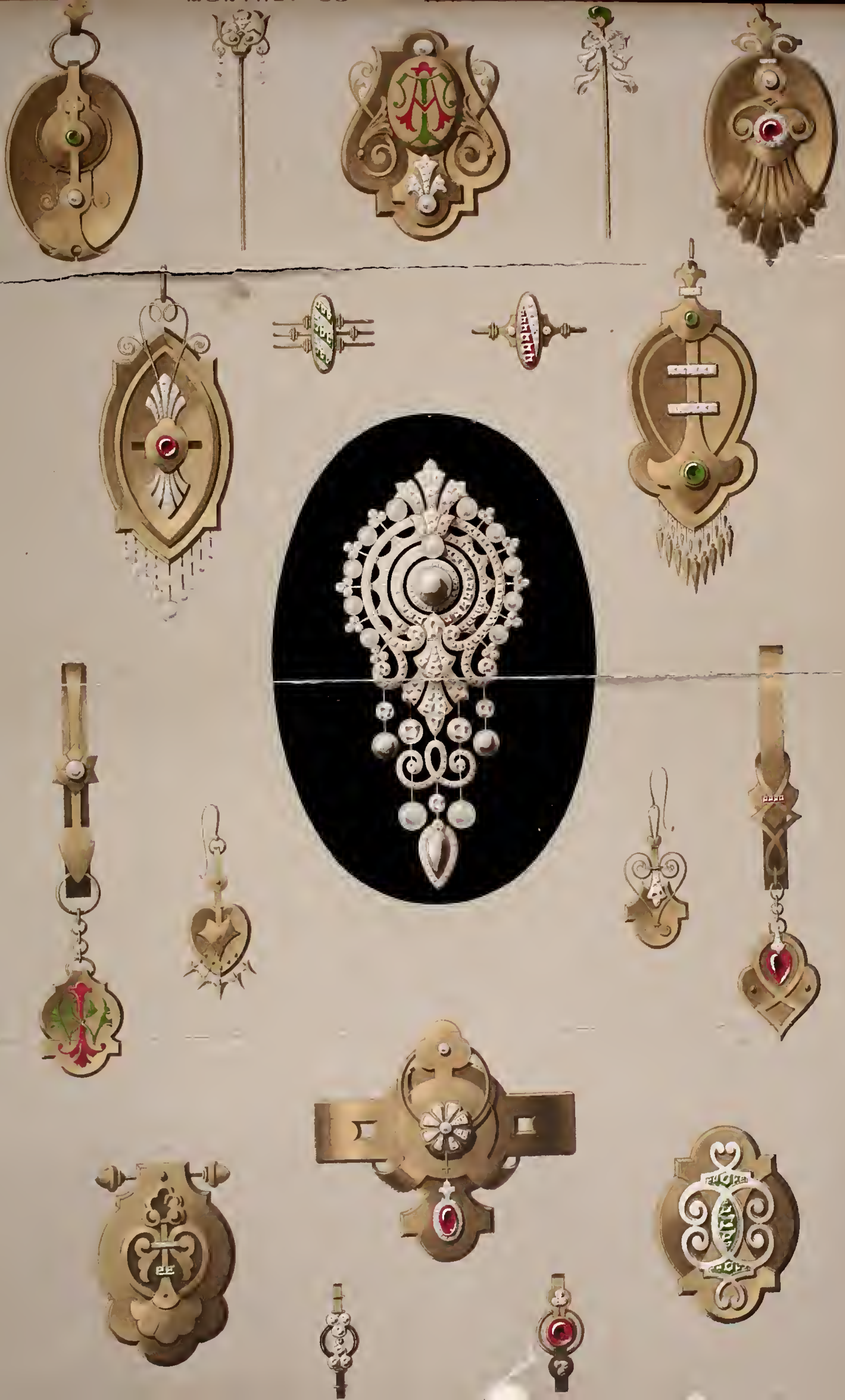

THE WATCHMAKER JEWELLER AND SILVERSMITH

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Our National Watch Factory.

By a Horological Zadkiel.

(Continued from page 54.)

In less than a week a letter was received from Jonathan, requesting some information as to the financial condition of the company, as he intimated that a particular friend of his (strongly suspected by the Secretary to be himself) had some thoughts of investing five thousand dollars in the concern, while the shares were at a reasonable figure.

As the first year of working had not quite terminated, the official balance sheet was not prepared, but the following details were forwarded.

The company started with a cash capital of £75,000, which was subsequently increased to £100,000, having power to call up £150,000 more, as set forth in the prospectus.

Of this amount £10,000 had actually been paid for tools and machinery, and a further liability existed of £5,000, to be paid the following year.

The building cost £9,000—£3,000 of which was secured by mortgage. £5,000 was spent in advertisements, and £2,000 in legal expenses.

At the present time the salaries and wages of the *employés* were absorbing £1000 weekly, but as their numbers were gradually increased, according to the progress of the work, the total sum paid in the first year did not exceed £20,000, and the cost of materials for the first lines of movements, and silver cases put in hand, amounted to £25,000.

A dividend of ten per cent. was guaranteed to shareholders in the second year of working; the Directors (with the exception of the Manager) to receive no remuneration beyond personal expenses, until the aforesaid dividend had been earned, but £5,000 was set aside to meet the liability.

The Managing Director and Secretary each received salaries of £500; further remuneration was based on *results*, the co-operative principle being a fundamental rule of the company. Internal fittings, lighting, warming, assessments, and other expenses absorbed £2,000, making a total of £70,000 actually expended; which, together with the liabilities just mentioned, came to £83,000 in the aggregate, leaving a balance of £17,000 legally available for manufacturing purposes in the ensuing year.

On the other hand, 10,000 watches had recently been invoiced at an average wholesale price of sixty shillings each, and orders were being executed for 20,000 more.

It was calculated that a yearly delivery or sale of only 60,000 machine-made watches would yield a profit of £15,000, and that the other departments of the business would bring it up to £20,000, making about twenty-five per cent. gross profits on the amount of working capital. In order to realise this, it would be necessary to turn the capital over twice in the course of the year, which those entrusted with the management had no apprehensions of not being able to accomplish.

As intimated in an earlier portion of this narrative, the company only employed three-fourths of their hands in the manufacture of machine watches proper, and 150 of these were engaged in the operations described last month.

According to the price of the watches, so the various parts received more or less hand labour; the highest grades were calculated to be fully as expensive as those made on the old system, but at present these had not been attempted.

Fifty hands were employed in fitting up and adjusting the various parts of the escapements after they had been turned, or stamped out by the machines, and an equal number in putting the watches together, ready for the springers and timers, twenty of whom occupied a separate apartment; and were each expected to turn out on an average, one an hour, ready for the final supervision of the head of the department.

Upwards of seventy were giving their attention to the manufacture of the cases, which were being made under the new *régime* of the system of voluntary hall marking, which, as mentioned at the inaugural dinner of the company, had recently become law.

For some years before this change took place attempts were made by a section of the trade to prevent the British hall-marks from being placed on foreign made cases, a practice which had prevailed for upwards of thirty years, and had greatly increased in the last ten; but so many conflicting interests were in operation that it was found impossible to secure anything like unanimity, more especially as it was regarded by many as being quite in accordance with the principles of Free Trade.

Indeed, in June 1878, the then leaders of the Horological Institute passed the following resolution:—

"That the hall-mark of the Goldsmiths' Company has not been regarded by the trade as a trade-mark for watches."

The question naturally arises, if this is correct, why did foreigners put themselves to the trouble of obtaining it, and also made a leading feature of it in advertisements? Without charging them with fraudulent motives, the reason is simply because they found the watches sell better when impressed with British marks, as it enabled retailers to state to their customers that they were actually their *own make*, an assertion which could not have been made if they bore marks which at once proved them to be foreign.

The old system of compulsory hall-marking contributed in no small degree to throw our markets open to the competition of foreigners, because we were actually prohibited from making the same class of watches that we had to contend against.

A well-known public man, when speaking on the subject in 1880, said: "Watches made and cased in the United Kingdom were compelled to be hall-marked, whereas watches of identically the same construction could be made abroad, and cased abroad, and sold in the United Kingdom un-hall-marked; or the cases could be made abroad and hall-marked in the United Kingdom; or the watches could be made abroad and the cases made and hall-marked in the United Kingdom (as in the case of the American Watch Company). Again, watch cases with metal domes could not be made in the United Kingdom, whereas such watches could be imported free of duty from abroad, and could be sold without let or hindrance. It was evident that the system of compulsory hall-marking as far as watches are concerned, is a system of protection of the foreigner as against the British producer."

The clerk to the Goldsmith's Company, in a special report presented to the Select Parliamentary Committee appointed to enquire into the question in 1878-79, said, "I am inclined to think that the marking of watch cases should not be compulsory. . . . I would leave them to be sold marked or unmarked, according to the will of the seller, and it is my opinion that the hall-mark is so much valued that the number of watches sent to be marked would not be materially lessened. . . . The object which the foreign makers of cases have in sending them to England to be assayed and marked is, it is stated that they may put foreign movements into them of a cheap and inferior character, and sell them in foreign markets as English made watches, the buyer being deceived by finding on the cases the English hall-marks, a practice by which the English watchmaker is undoubtedly injured."

The agitation on the matter was again revived on the change in the Government in 1884, and the following session the Chancellor of the Exchequer announced in his financial statement that the system of compulsory hall-marking and the duties on gold and silver wares would be abolished in 1887, but that as there were no duties to collect on watch cases, the existing regulations with regard to them would lapse at once, except in the case of fraudulent imitations of the official marks. Therefore, the National Watch Company commenced their operations without any restrictions as to the style or quality of their cases, of course finding it to their own interest to accommodate the nature of the stock to the markets it was required for.

(*To be Continued.*)

Artificial Ivory.

Up to the present time the greatest difficulty experienced in the manufacture of articles of artificial ivory has been the belief that it was necessary, in order to secure the required strength, to employ a very large percentage of a binding substance, the result being that the obtained product did not show a nice colour, and its application could not be extended to articles for which a pure white was required.

Mr. J. S. Hyatt obtains artificial ivory, which is perfectly white, and is adapted for all purposes, by employing a very small percentage of binding material, which is, however, sufficient. This result is obtained by the use of a solvent in which the glue is dissolved. The inert body is then added to the solution, and the mixture is ground. The solvent is then eliminated, and the mixture is ground again when dry, and pulverised. The powder thus obtained is put into moulds and exposed to great pressure under the action of heat. As a binding substance, shellac or any vegetable glue can be used. As the inert body, any substance which does not melt under the action of the heat, and which is capable of being pulverised. As solvent, any substance which will answer the purpose can be employed. A good result is obtained with ammonia.

The inventor proceeds as follows: A solution is prepared of 8 parts of shellac and 32 parts of ammonia, of 0,995 specific gravity, the whole being agitated in a rotating cylinder until complete dissolution (about five hours), the temperature being kept as nearly as possible at 37½° Cent. To this solution is added about 40 parts of oxide of zinc, of good quality, and well mixed. The mixture is put into a colour mill, and ground as well as possible. The ammonia is now eliminated by evaporation. For this purpose the mixture is spread over glass plates. When the mixture is dry it contains only shellac and oxide of zinc. In order to secure a perfect quality of the articles, the dry mixture is again ground very fine before being put into the mould, the temperature of which is kept at about 125° to 137½° Cent. If the article has to be coloured, a colouring matter can be added to the solution before grinding, or to the dry mass before it is ground for the second time.

The Worthies of Horology.

By C. Stuart Murray.

VIII.

DIFFERENT countries have, as may be understood, different names for the time-keeping instruments of the house and the pocket. In Latin the word *horologium* is used; in Italian, *orologio* and *oriulo*, both coming from the root *hora*. Thus, in Latin they would say—"*Hora quota est*"?—What o'clock is it? *In horam vivere;* to live from hour to hour—"from hand to mouth," as it were; or as the watchmaker might smilingly whisper to the disappointed inquirer about the "job"—*Crastina hora;* to-morrow. In Italian, both the terms were used indifferently for clocks and watches, the distinction being shown by the equivalents for the terms house, turret, or pocket. Again; the French say, *montre* for a simple watch; *montre à réveil*, alarm watch; and *montre á répétition*, a repeating-watch; or, as we should say, a repeater. The origin of the English term watch, for a time-keeeping instrument, has not been very clearly defined from a philological point of view; but, if we use custom and common sense, we arrive at a satisfactory answer. If we say that a watch takes its name from its purpose, which is that of enabling us to *watch* the hours as they pass, we shall be able to get along very well without any philology whatever.

Turning again to Gaspar Visconti, it seems almost incredible that such complex machines, as he praises, should have existed towards the close of the fifteenth century. He has told us that these "pocket clocks" struck the hours, as well as showing them upon the dial. Even in these days, with all our knowledge and appliances, the clock-watch requires a good deal of making. It is related, as not a little singular, that after the time of Peter Hele, no worthy of horology arose for nearly a hundred and fifty years. It may not be generally known that in 1530, Gemma Frisius, a Dutch Worthy of astronomical horology, suggested that "pocket clocks" should be used to ascertain the longitude at sea. That is slightly over three hundred and fifty years ago, and is the earliest notice of the kind with which horological history seems to be acquainted. Very little is known in this country about him, except that he was an astronomer, and that his name is most probably derived, not from a family, but from the people to whom he belonged. The Frisians were an off-shoot from the Germans, and inhabited what is now Holland from a very early period.

There is a curious incident in tracing these landmarks which has only been casually noticed here and there, but one important particular I have never seen explained, that is, who was the horological Worthy of the affair. The story is worth telling, although it takes us back to the thirteenth century.

It appears by the year book of Richard the Third, about the year 1483, that he had closeted the judges in the Inner Star Chamber, to take their opinions upon three points of law. Having decided the first, they were to say, "whether a justice of the peace, who had enrolled an indictment which had been negatived by the grand-jury, amongst the *true bills*, might be punished for this abuse of his office?" Adversity of opinion arose among the judges upon this question. Some maintained that a magistrate could not be prosecuted for what he might have done, whilst others contended that he might, notwithstanding that the offence was committed in the execution of his office. They cited the case of Chief Justice Hengham, who was fined eight hundred marks for making an alteration in a record, by which a poor defendant was to pay only six shillings and eightpence, instead of thirteen and fourpence. Now, we must go back to the high offender.

Blackstone, in his celebrated Commentaries on the Laws of England, tells us that this punishment of Radulphus de Hengham is first taken notice of in the year book during the reign of Richard the Third, and it is in consequence of that notice that the English public became afterwards acquainted with the matter. The account is, that Chief Justice Hengham having altered the record, as previously stated, was fined in the sum mentioned, and the fine was applied in the construction of a clock upon a building facing the entrance to Westminster Hall, with this warning motto:—"*Discite justiciam moniti*"! "learn justice from my advice." The words are portions of a line from the Latin poet Virgil, the full verse being "*Discite justiciam moniti et non temnere divos*"—"learn justice from my advice, and not to despise the gods." This clock of penitence was made, put up, and set going, and continued to go for many a year. In fact, so much importance was attached to it in the reign of Henry the Sixth, 1422 to 1460, that the king gave the keeping of it, with the "appurtenances," to William Warby, dean of St. Stephens, and a payment of sixpence a day to be received at the Exchequer. The clock is stated to have been in its place until the time of Queen Elizabeth; when, being decayed, it was removed, and a dial only remained. The clock-house continued, but in a ruined state, until the year 1715.

Now, the chief question up to which all this historical explanation has led: Who was the horological Worthy who made that clock? The clock was made in England, very likely in London, and yet I have been utterly at fault in finding out the name of that horological Worthy. It would not be of any service to dive further into the inquiry, for there seems to be no gleam of light respecting who the clockmaker was.

Her majesty has a clock at Windsor Castle, with a sad historical memento attached to it, an engraving of which is before me. This is no other than the actual timepiece presented by King Henry the Eighth to the fair, but unfortunate Anne Boleyne, on their marriage in November, 1532. As far as the appearance of the case and dial go, it certainly is the most artistically built article of the kind that can be well imagined. It is an upright square timepiece, standing on a bracket having a sloping triangular support in front resting against the wall. The top of the case is surmounted by a carved dome of highly-wrought ornamentation. What may be termed the platform of this dome is made prominent by pinnacles terminating the four pillars supporting the sides, these pillars, too, being quite in keeping with the other work. On the left hand side is the door to the interior, having carved upon it the royal arms and crown. The dome is open-work, and at the summit is the royal shield, held in place by the forepaws of the heraldic lion, whilst the head of the kingly animal itself is keeping "watch and ward" high over all. There is only one weight, apparently lead cased in brass, and even that is engraved. Around it at the upper end is the royal motto, "Dieu et mon droit." Below that is a circle enclosing on the upper part a true-lover's knot; then the letters H. A. (for Henry and Anne) and another true lover's knot below in the same circle; down to the end of the weight is more ornamentation. The front of the bracket has medallions of both male and female heads let into sunken panels. There is only one hand, and that for the hours, the pointer end being of the fleur-de-lis pattern. The hour circle is in Roman numerals, such as are used now, and encloses some elaborate flower engraving. The circle rests on a square plate, which is also elaborately wrought at the four corners.

Such is that famous clock; and whilst reading about it, it is lamentable to think that in four years the doomed queen, who was crowned with great pomp and public manifestations, was led to the block and beheaded by the order of the cruel, lustful, and savage man who had made her such a right royal present. Her majesty, Queen Victoria, must feel melancholy and heart-stricken when she looks at that mournful memento of such an unjustly ruined sister in dignity; a sister whose eyes often gazed with loving fondness upon that same hand and dial. The size of this clock is, from the base to the cornice above the face, five and a-half inches, and from thence to the lion's head five inches more; the sides are each four inches square.

Alas! I am sorry to say that even the best horological antiquarian of whom I have heard has been unable to find out who made that historical clock for Henry the Eighth. It has been modernized for the application of a pendulum, and may now for many years to come show the beautiful workmanship of the period in which it was made; but the case remains unaltered in all its splendid originality, to show us what that class of workmen could turn out in the sixteenth century. Many of those old clocks, down to the beginning of the last century, have been adapted to modern requirements.

There is a drawing of a curious clock attributed to De Louabe, a German, who was born in 1300. It is mounted ornamentally, and the drawing of it will be found in an illuminated manuscript in the British Museum, entitled *L'Orlage de Sapiensse.* The drawing shows an ecclesiastical judge hearing a cause. Three counsel are on each side of him, and two others near are listening attentively. Between these listeners is placed the clock in question, with its bell and weights. Below the drawing is some writing in old French, by which men are exhorted to avoid vice and negligence, and be watchful in their duty, since the Deity is ever desirous of renewing our energies as regularly as a clock. Another manuscript volume is to be found in the British Museum which was written about the middle of the fourteenth century, also containing a drawing of a clock by a name which has not been preserved. What a regret that these Worthies of horology in their identity have been lost. The clock depicted in the drawing represents a cardinal seated and attended by the four cardinal virtues. These are represented by Justice, Prudence, Temperance, and Fortitude. Of these, Temperance, habited in the long robes of the age, is holding upraised a pair of spectacles in her right hand, whilst a small clock is resting on her left. She is wearing a white veil, blue bodice, sleeves with gold borders, a skirt with an embroidered edge, and black shoes. The clock is slate-coloured and has a red dial and two gold hands, besides ornaments. The motion is given by two weights suspended by cords. It seems to be sufficiently compact in its construction, so far as the mechanism is concerned; but it has an unusually large bell at the top, for a clock of that size, and the hammer strikes on the opposite of the bell to that to which it is fixed.

The designers and makers in those days were always trying to symbolise morality and religion in their work, and succeeded generally to admiration. They reasoned thus:—For a man to live virtuously, it is necessary that he should know what is fit to be done by him in his actions, which doing is the business of *prudence.* Next, that he have a constancy and firmness attendant upon him, so as to go evenly on the way of what is right; this they called the business of *temperance.* Then came the vital energy to deal with adversity and contend against difficulties, which they rightly named *fortitude.* Last, but not least, came a man's dealings with the society among which he lived, and friendly and fair dealing they denominated *justice.* The force and appropriateness of these symbolisms will be more fully comprehended when I add that, even in puritanical times, it was an everyday matter to christen children from the titles of religious virtues, such as Faith, Hope, Charity, &c.

Following this argument up a little further, for it is really very interesting, the enquirer after these curiosities may be pleased to learn that, in the Bodleian Library, Oxford, there is another horological drawing on an illuminated vellum manuscript, dated with the year 1450, entitled in French, *Les Quartre Vertus*—the four virtues. Two full-dressed ladies appear on each side of the picture, with a clock between them, the works of which are directed by the hand of a female to the starry firmament; in other respects the machine is quite as curious as the one last described. Temperance has been typified in many ways in this world; but that of a woman plunging a red-hot poker into cold water has a certain amount of comicality about it. In the case which has been previously related, that desirable virtue has been placed in company with Time. Of course, Time symbolised regularity to the action of all the other moral virtues, and was not confined as it seems to be now. Nor was temperance "cabined, cribbed, confined," as at the present day, to drunkenness." Even in Shakespeare's day, when the world of England did not by any means go as fast as it does now, we find that in Henry the Fifth, he puts it into the mouth of Exeter to say to the Dauphin,—"Now he weighs time, even to the utmost grain." In the same illuminated manuscript is another curious drawing of symbolic horology. Temperance is seen standing under a porch and upon a windmill. She has a pair of spurs on, holds spectacles in her left hand, whilst her head-dress consists of a small clock, surmounted by a turret-pattern bell and hammer; some iron bands come down on each side of the head to the breast to hold the clock steadily by.

Such are a few of the curiosities which one has to unearth, as it were, from the buried treasures of Museums, or wherever they can be found.

Index to Antique Rings and Ornaments.

67—Gift or bethrothal ring in the Londesbourg collection. It bears the name of the Saviour in full, in uncial characters. It is silver and somewhat rudely fashioned.

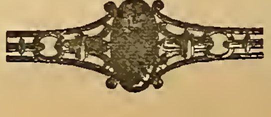
68—Specimen of religious ring (fourteenth century) in the same collection. On the upper edge of the ring are five protuberances on each side; they were used to make a certain number of prayers, said by the wearer, who turned his ring as he said them, and so completed the series in the darkness of the night.

69—Ancient Irish brooch.

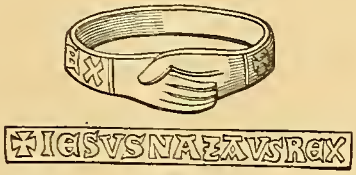
70—Another prayer ring with nine prominent knobs. They are termed decade rings when furnished with ten bosses as this specimen.

71—Episcopal ring, in possession of the Dean of Winchester. It was found during the repair of the choir, under the tomb of William Rufus, and is supposed to have been the pontifical ring of Henry de Blois, cardinal, and Bishop of Winchester, A.D., 1129. It is set with an oval irregularly-shaped sapphire, *en cabochon*, polished only, not cut.

72—An ordinary pontifical gold ring of investiture, used in the Anglican church about the twelfth century. It was also found at Winchester, and is preserved with the ring described above. It has a very massive setting for a large blue sapphire.



ANTIQUE RINGS AND ORNAMENTS.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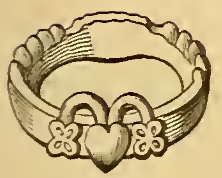

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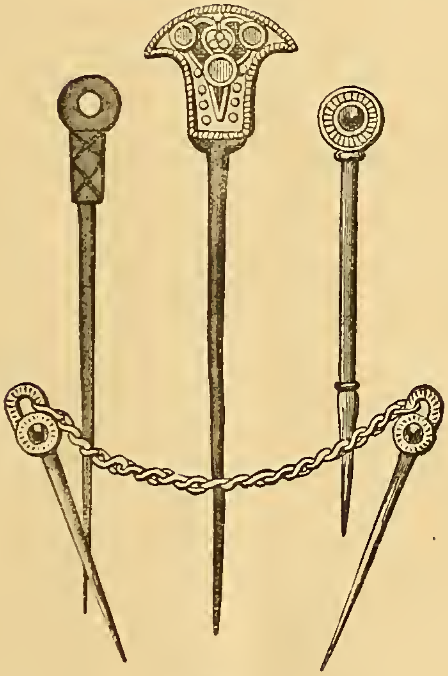

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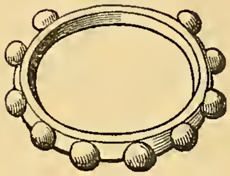

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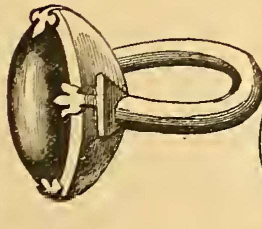

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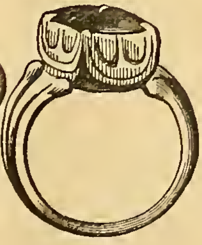

72.

For Description, see page 70.

Sir Garnet Wolseley on Technical Education.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—At the present time the opinions of our "only General" (including those upon the Channel Tunnel) command an unusual amount of respect and attention in all quarters; and as the question of technical education *v.* practical knowledge is continually being discussed, it occurred to me that the following extract from a well-known work, compiled by him in 1874, entitled, "The Soldier's Pocket Book for Field Service," would be interesting.

Writing on the qualifications of staff officers, he says:—"The worst S. O. I knew in the Crimea had taken the highest degree in the senior department at Sandhurst. I do not wish to insinuate that learning is injurious, but to prove that scientific attainments alone will never make a staff officer."

This opinion was subsequently borne out by the unfortunate circumstances which attended the death of the late Prince Imperial of France. The officer in command of the party, who, to put it mildly, lost an exceptional opportunity of distinguishing himself, held the highest possible certificates from the military colleges.

The object I have in quoting the preceding illustrations is to warn the rising generation of watchmakers from thinking that technical knowledge is to be placed on the same footing as practical skill; it is quite an exception for the qualities to be equally combined in the same individual. References to the biographies of eminent mechanicians will show that they were, for the most part, "self-made men." Technical knowledge acquired in mature age, after practical details have been thoroughly mastered, is likely to be turned to more beneficial results than when the reverse is the case.

I have in my mind's eye a well-known chronometer maker, some time deceased, who, I am informed, was taken from school at the age of ten, in order to commence such a thorough course of training as would not be possible in these days of suburban residences and bank holidays. The idea of acquiring knowledge was, nevertheless, dominant within him, and his earliest pocket money (rather a scarce commodity at that time) was devoted to the purchase of serial numbers of the standard educational literature of the period, which were subsequently bound. At the age of thirty-five, he would frequently study the problems of Euclid at breakfast time, as a prelude to the more serious business of the day. With it all he never made the slightest claim to be regarded as an oracle, and the most he was ever known to say was, that "he thought he could make a chronometer."

Thoroughly practical men are almost invariably reticent; their knowledge has been attained by a process only known to themselves, and they rarely care to impart it to others. Hence, it is necessary to fall back upon theoretical professors, who do not have the opportunity of actually testing the practical abilities of their pupils.

It is to be regretted that the examination of the City and Guilds Institute does not make provision for the admission of practical work.

In the good old days of Continental guilds, an apprentice had to complete a given piece of work in a certain time, at the expiration of his term of servitude, before he received permission from the Burgomaster to practise as a master craftsman; and I would very much like to see something of the same sort of thing revived at our own examinations.

The simplest operations are often those which require the most skill, and a trained workman may be distinguished from an amateur by the manner in which he examines any piece of work that is shown him.

It is absurd to hear youths talking learnedly about the angles of pallets, &c., before they have mastered the first rudiments of their business. With the deepest submission to the City and Guilds Institute, I would suggest the following tests as forming part of a practical examination.

1.—The whetting up of gravers for various purposes.

2.—Filing steel "four" and "eight" square.

3.—Making proper drill stocks, drills, and polishers.

4.—Cutting off circular pieces of brass in the vice and drilling straight holes in the same, then turning them true in the turns, with the least possible diminution in size.

5.—Making a balance staff and roller, in a certain time, to a given size; also filing up a stud.

The above would fairly form a test of the abilities of a pupil, and might be performed in any place where the examination was held. It would also be very useful for pupils to have the opportunity of making themselves acquainted with the working of the various machines which are in use at the present time, for the purpose of producing watches in quantities; such illustrations are surely within the reach of a public body, and could not fail to excite great interest in the trade.

Until comparatively late years, we watchmakers have not bestirred ourselves much in the matter of inventions, but have staked our reputation on the solidity and durability of our productions.

A century ago, during the French war, it was said that the French ship builders designed their vessels on artistic and scientific principles, whereas we proceeded by the rule of thumb, only as a set off we captured their ships and copied them, and I submit that the power to do the latter is equally valuable with the former.

As I commenced with a military illustration, I will close with one. Twenty-two years ago, the Inspector General of Volunteers said on one occasion, "You MUST do COMPANY drill; I WILL harp upon Company drill." The application is obvious; and I need not further occupy your space by amplifying it.

Nov. 28th. JAMES U. POOLE.

Tempering by Compression.—L. Clémandot has devised a new method of treating metals, especially steel, which consists in heating to a cherry red, compressing strongly, and keeping up the pressure until the metal is completely cooled. The results are so much like those of tempering that he calls his process tempering by compression. The compressed metal becomes exceedingly hard, acquiring a molecular contraction, and a fineness of grain, such that polishing gives it the appearance of polished nickel. Compressed steel, like tempered steel, acquires the coercitive force, which enables it to absorb magnetism. This property should be studied in connection with its durability; experiments have already shown that there is no loss of magnetism at the expiration of three months. This compression has no analogue but tempering. Hammering and hardening modify the molecular state of metals, especially when they are practised upon metal that is nearly cold, but the effect of hydraulic pressure is much greater. The phenomena which are produced in both methods of tempering may be interpreted in different ways, but it seems that there is a molecular approximation, an amorphism, from which results the homogeneity that is due to the absence of crystallization. The advantages of the new method are obvious. Being an operation which can be measured, it may be graduated and kept within limits, which are prescribed in advance; directions may be given to temper at a specified pressure, as readily as to work under a given pressure of steam.

Hall-marking.*

By G. E. Gee.

(*Continued from page* 45).

WE are not arguing against the continuance or maintenance of the British hall-mark, but rather against the form it takes with regard to the punches employed, and its compulsory application to certain wares, already specified in these pages. What we advocate is, by all means let us have an hall-mark, to be applied when necessary or when desired, but let it be a simple and intelligent one, easy of recognition by the public, and applicable to the work in hand. Make the hall-mark uniform in its representations, so that it may be universally acknowledged as a purely British mark for the sole use and benefit of British artisans; but let its employment be voluntary, the law as regards its infringement more stringent, and all foreign-made goods prohibited from bearing a similar impress. Let the mark be purely and essentially the acknowledged hall-mark of Great Britain; this would be a notification to all the world as to the standard quality, as well as being of British manufacture, in regard to any article bearing its impress.

The mark should be the same for England, Scotland, and Ireland, to make it a purely representative one, and the punches reduced in number, and made uniform at all the assay halls in the United Kingdom. We now have the different punches of the *leopard's head* for London, the *anchor* for Birmingham, the *dagger between three wheat sheaves* for Chester, the *crown* for Sheffield, the *castle with three towers* for Exeter, the *three castles* for Newcastle-upon-Tyne, the *castle* for Edinburgh, the *tree, bell, and fish* for Glasgow, and the figure of *Hibernia* for Dublin. All these are so numerous and confusing as to be very difficult of identification, even by those well acquainted with the matter. How, then, must it be with the purchasers of jewellery who know but little about it, and who constitute the great majority of those immediately interested in it? What is wanted is some simple and intelligent mark that cannot possibly be mistaken, either by makers or dealers, or by purchasers; and this cannot be better accomplished than by having one mark, to be known as "the hall-mark," at all the assay offices in the United Kingdom. We are not, however, advocates for compulsory hall-marking in any form, much preferring the voluntary system, as it now applies to the lower qualities of gold jewellery.

To do away with the hall-mark altogether, would be taking away that guarantee which is now so much relied on abroad by a certain class of purchasers; for it should be borne in mind, that it is not so much in the sale of jewellery at home as abroad that the hall-mark does such signal service, as in the latter case there is nothing specific in proof of the genuineness of an article, save the English hall-mark. We cannot see the necessity for the compulsory hall-marking of a few special articles, while the great majority of the wares that are made are absolutely exempted from, not only the compulsory provisions of the law as regards similar manufactures, but also from any test-marking whatever. It is a well-known fact, that the English hall-mark is much valued abroad, where it is received as a certificate of quality whereever it goes, without question, in fact, just as readily as the impress of the Queen's head upon our gold and silver coins is acknowledged as evidence of its being British money. But the English system of hall-marking can only be applied to articles of gold and silver that are plain and solid in construction, and not to wares that are light or hollow in make or artistic in design; and this, because anything that required intricate or delicate workmanship, would become so defaced by the process of marking as to be wholly unfit for sale afterwards. To make the law, therefore, compulsory in regard to all articles alike, would be utterly impossible with the present system adopted of affixing the marks to the work; but to allow the vast majority of manufactured gold and silver wares to go unmarked, because they are not adapted to the method of marking, but which are, nevertheless, allowed to assume certain marks, closely resembling the authorised ones without their legal liability, is rendering the genuine hall-mark of little value to the public, because it is so closely imitated by the stamping of the same numerals, as to utterly deceive ordinary buyers.

Under the present compulsory system, which affects a certain class of work, and allows another class to assume marks somewhat resembling the genuine hall-marks, in so far as they indicate the quality of the work, we have no definite and comprehensive *British mark*, by means of which the inexperienced could readily distinguish the real from the false.

What is wanted, to our mind, is some simple process of voluntary hall-marking applicable, if necessary, to all the manufacturers in gold and silver. In this way there could be no deception, for the purchaser could then order from the manufacturer hall-marked work or otherwise at his option, and pay for it accordingly. The work not hall-marked could be accompanied by some sort of guarantee as to quality, for which purpose the invoice charging the goods and stating the quality upon it should be considered sufficient. But then it may be said that this is all very well in regard to the first transaction or purchase from the manufacturer, and that when articles pass through many hands in the ordinary course of business this plan might be rendered futile by the selling of inferior standard qualities for the better ones. We think, however, this could be remedied by placing a specific quality mark upon the work by the manufacturer, in a similar manner but quite distinct from the Government mark. Let the law which now prescribes the fixed standards also provide for the marking of *all* wares, either by experts who are not interested in the work or by the manufacturer himself, to indicate the fineness of the metal of which they are composed, under pain of severe penalties for all violations of the law. This would soon prevent the imposition upon the public of inferior or base metal for the genuine or standard degrees of fineness.

The hall-mark which is now put upon the standards and recognised by law is a matter perfectly separate from, and independent of, the manufacturing interest. The work is (as most people know) tested, and the marks stamped on it by persons who are in no way connected with the manufacture of the articles that come before them. The maker of the various kinds of goods required to be hall-marked has no power to place the mark upon his wares; he has to send them to the officials authorised by the law to do it, and they are either returned duly stamped with the proper symbol or hieroglyphics in indication of their true quality, or, if otherwise, they are returned defaced, having been broken up in consequence of their being below the fineness required. This is one of the greatest evils of our present English hall-marking system—the defacing of the work; for if found only a quarter of a grain under the specific standard it is entirely defaced or broken up, and is thus rendered only fit for the melting pot. Now, what possible difference could so small a deviation from the true standard make to the purchaser, or even to any one interested at all in the matter? In gold it represents about a halfpenny per ounce; in silver about the eighth of a farthing only. In any new arrangement concerning the hall-marking system this matter will have to be taken into serious and practical consideration, with a view to the better adjustment of it, and for the advantage of all parties concerned. By the strictness with which the cutting and defacing is now carried on by the various guilds, it is in many cases a serious loss to the manufacturer.

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* From the "Hall-marking of Jewellery Practically Considered."

The numerals which are always put on English hall-marked work are also put on other things which are not hall-marked, and so many persons are often taken in with goods marked with some of these numerals, such as 18, 15, 12, 9, &c. (which figures purport to represent those qualities respectively in fine gold), if they do not look for the other hieroglyphics, which are specially intended as safeguards for the protection of the too-confiding British public. What is required in the future, and what we should much like to see, is the abolition of some of these cabalistic signs, and a *distinctive Government stamp* substituted in their place, to be impressed upon all wares at the option of the intending purchaser; the stamp to be the same for all places, significant in its import, and its detection simple and plain, so that it could be easily understood by all persons.

The present English hall-marks are so varied and representative in character as to render them confusing and difficult of explanation. To purchasers abroad, where American goods are in demand, the English hall-marks render very little service in the hands of a non-expert, for some of the American goods bear close imitations of our hall-marks, which can only act greatly to the detriment of our manufactures abroad. These goods, in many instances, are nothing more than base metal cased with gold, and bearing such of our stamps as are considered of the highest importance by members of the English trade. The ones most commonly imitated are the *lion*, the *crown*, and the *anchor*, with the quality numerals impressed by the side of them in the same manner as on English hall-marked work, and which are authorised by English law.

Practical Instructions to Jewellers, Silversmiths, and Electro-platers.

By A. Roseleur.

Specially Translated and Revised for this Journal.

XLII.

Simple Apparatus for Amateurs.—Place the solution of sulphate of copper in a stoneware, earthenware, or porcelain vessel, in the centre of which stands a porous cell filled with water, with two or three per cent. of sulphuric acid, and one per cent. of amalgamating salts. This liquid must surround an inner cylinder of zinc, upon the top of which reasts a circle of brass wire, by two cross bars soldered, or fixed in four notches on the top of the zinc cylinder. Suspend from this circular framework, projecting over the copper solution, a certain number of objects or moulds, immersed in the liquid in such a way as to have their faces to be covered near and opposite to the cell. Two small hair bags, filled with sulphate of copper crystals, should be attached to the upper edge of the vessel.

Large Apparatus.—To cover large surfaces, use a bath contained in a large wooden trough, lined inside with gutta-percha or lead, or other substance unacted upon by the bath. In the middle of the trough dispose a row of cells close to each other, and each with its zinc cylinder. Connect a thin metallic ribbon with all the binding screws of the cylinders, in contact at its extremities with two metallic bands on the ledges of the trough. The metallic rods to support the moulds are placed in contact with the metallic bands of the ledges, and therefore in connection with the zinc. If the objects are in high relief, use a circular trough, place the cells in a circle, and the mould to be covered in the centre. Whatever the shape of the mould, its position should now and then be changed, because the lower layers of the bath give more abundant deposits, owing to the difference of specific gravity of the layers more or less charged with sulphate. As far as practicable, maintain the liquids in the bath and in the cells at the same level; or it is better to have that of the bath slightly above that of the cell, to prevent the solution of zinc from mixing with the copper bath.

Porous Cells.—Pipeclay, pasteboard, bladder, gold-beaters' skin, parchment, sail-cloth, and certain kinds of wood may be employed, but nothing equals porcelain clay, submitted to a certain heat, which hardens the paste without destroying its porosity. Vases made with this material are just porous enough, and resist the action of concentrated acids.

Batteries.—The battery, charged as has been described, will work well for twenty-four hours; and, for four consecutive days, it will only be necessary to add small quantities of acid and amalgamating salt, in proportion to the volume of the cells. Stir the mixture each time with a glass rod. The fifth day, throw away all the exciting liquors, and substitute fresh ones, otherwise the zinc salt will be so abundant as to crystallize upon the zincs and the cells. A cell may be clogged in two ways,—by the sulphate of zinc which, having an insufficiency of water, crystallizes in the pores. In this case boil the cells in water acidulated by sulphuric acid. Or by deposits of copper caused bad working; dip the cells in aquafortis until all the copper is dissolved, and rinse in plenty of water afterwards. It is also possible to clean cells by keeping them filled with water, which, escaping through the pores, pushes out the salts and the acids with which they are clogged. Cast zinc will work, but is far inferior to laminated zinc, which will be uniformly corroded instead of perforated. It sometimes happens that zinc is scarcely attacked, even by concentrated liquors, and that a multitude of small cavities are engraved on its surface. It also becomes covered with a blackish-grey crust, and no electricity is disengaged. These inconveniences occur when the zinc is too rich in lead.

Amalgamating Salt.—To avoid the solution of the zinc when the apparatus is not at work, cleanse it in diluted hydro-chloric acid, and then amalgamate it by rolling the cylinders in a trough filled with mercury.

Impromptu by a gentlemen to a lady who enquired why he kept his watch on his left side:—

Your question dear lady is fair,
  So is your face for the matter of that;
My reply will be plain, *au contraire*,
  Like the face of my watch, and that's flat!

Why it's kept on the left-side, indeed,
  Instead of the opposite part,
Is because in your presence there's need
  To keep a *watch* over the heart.

Mr. Whittaker's contribution on "A Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models," arrived too late for insertion in the present number.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(Continued from page 60.)

Bullion submitted to a Parting Assay, and reported to contain in the pound troy either Fine Gold or Fine Silver.

		dwts.	grs.		grs.
12 ozs.	contains per oz. ..	20	—	and per dwt. ..	24
11 ,,	,, ,, .	18	8	,, ,, ..	22
10 ,,	,, ,, ..	16	16	,, ,, ..	20
9 ,,	,, ,, ..	15	—	,, ,, ..	18
8 ,,	,, ,, ..	13	8	,, ,, ..	16
7 ,,	,, ,, ..	11	16	,, ,, ..	14
6 ,,	,, ,, ..	10	—	,, ,, ..	12
5 ,,	,, ,, ..	8	8	,, ,, ..	10
4 ,,	,, ,, ..	6	16	,, ,, ..	8
3 ,,	,, ,, ..	5	—	,, ,, ..	6
2 ,,	,, ,, ..	3	8	,, ,, ..	4
1 ,,	,, ,, ..	1	16	,, ,, ..	2
19 dwts.	,, ,, ..	1	14	,, ,, ..	1·9
18 ,,	,, ,, ..	1	12	,, ,, ..	1·8
17 ,,	,, ,, .	1	10	,, ,, ..	1·7
16 ,,	,, ,, ..	1	8	,, ,, ..	1·6
15 ,,	,, ,, ..	1	6	,, ,, ..	1·5
14 ,,	,, ,, ..	1	4	,, ,, ..	1·4
13 ,,	,, ,, ..	1	2	,, ,, ..	1·3
12 ,,	,, ,, ..	1	—	,, ,, ..	1·2
11 ,,	,, ,, ..	—	22	,, ,, ..	1·1
10 ,,	,, ,, ..	—	20	,, ,, ..	1
9 ,,	,, ,, ..	—	18	,, ,, ..	0·9
8 ,,	,, ,, ..	—	16	,, ,, ..	0·8
7 ,,	,, ,, ..	—	14	,, ,, ..	0·7
6 ,,	,, ,, ..	—	12	,, ,, ..	0·6
5 ,,	,, ,, ..	—	10	,, ,, ..	0·5
4 ,,	,, ,, ..	—	8	,, ,, ..	0·4
3 ,,	,, ,, ..	—	6	,, ,, ..	0·3
2 ,,	,, ,, ..	—	4	,, ,, ..	0·2
1 ,,	,, ,, ..	—	2	,, ,, .	0·1
½ ,,	,, ,, ..	—	1	,, ,, ..	$0^{1}/_{20}$

The most rational calculation for alloying the various Standards, or finding the quantity of precious metal in Bullion and determining the value thereof is undoubtedly by Milliemes or the Decimal system, and as this mode is adopted in nearly every country, a Conversion-table of the English Trade-reports into Milliemes, and *vice versâ*, will afford a comparison of the different notations.

Compared Assay-Reports on Gold Bullion.

Trade Report.						Carat. Fine.	Equivalent of	
							Fine Gold.	Alloy.
Better	2	carat			=	24	1·000	·000
,,	1	,,	$3\frac{3}{4}$	gr.	=	$23^{15}/_{16}$	·998	·002
,,	1	,,	$3\frac{1}{2}$	,,	=	$23^{14}/_{16}$	·995	·005
,,	1	,,	$3\frac{1}{4}$	,,	=	$23^{13}/_{16}$	·992	·008
,,	1	,,	3	,,	=	$23^{12}/_{16}$	·990	·010
,,	1	,,	$2\frac{3}{4}$	,,	=	$23^{11}/_{16}$	·987	·013
,,	1	,,	$2\frac{1}{2}$	,,	=	$23^{10}/_{16}$	·985	·015
,,	1	,,	$2\frac{1}{4}$	,,	=	$23\ ^{9}/_{16}$	·982	·018
,,	1	,,	2	,,	=	$23\ ^{8}/_{16}$	·979	·021
,,	1	,,	$1\frac{3}{4}$	,,	=	$23\ ^{7}/_{16}$	·977	·023
,,	1	,,	$1\frac{1}{2}$	,,	=	$23\ ^{6}/_{16}$	·974	·026
,,	1	,,	$1\frac{1}{4}$	,,	=	$23\ ^{5}/_{16}$	·971	·029
,,	1	,,	1	,,	=	$23\ ^{4}/_{16}$	·969	·031
,,	1	,,	$0\frac{3}{4}$	,,	=	$23\ ^{3}/_{16}$	·966	·034
,,	1	,,	$0\frac{1}{2}$	,,	=	$23\ ^{2}/_{16}$	·964	·036
,,	1	,,	$0\frac{1}{4}$	,,	=	$23\ ^{1}/_{16}$	·961	·039
,,	1	,,	—	,,	=	23	·958$^{1}/$	·042
,,	—	,,	$3\frac{3}{4}$	,,	=	$22^{15}/_{16}$	·955	·045
,,	—	,,	$3\frac{1}{2}$	,,	=	$22^{14}/_{16}$	·953	·047
,,	—	,,	$3\frac{1}{4}$	,,	=	$22^{13}/_{16}$	·950	·050
,,	—	,,	3	,,	=	$22^{12}/_{16}$	·948	·052
,,	—	,,	$2\frac{3}{4}$	,,	=	$22^{11}/_{16}$	·945	·055
,,	—	,,	$2\frac{1}{2}$	,,	=	$22^{10}/_{16}$	·943	·057
,,	—	,,	$2\frac{1}{4}$	,,	=	$22\ ^{9}/_{16}$	·940	·060
Better	—	carat	2	gr.	=	$22\ ^{8}/_{16}$	·937	·063
,,	—	,,	$1\frac{3}{4}$	,,	=	$22\ ^{7}/_{16}$	·935	·065
,,	—	,,	$1\frac{1}{2}$	,,	=	$22\ ^{6}/_{16}$	·932	·068
,,	—	,,	$1\frac{1}{4}$	,,	=	$22\ ^{5}/_{16}$	·929	·071
,,	—	,,	1	,,	=	$22\ ^{4}/_{16}$	·927	·073
,,	—	,,	$0\frac{3}{4}$	,,	=	$22\ ^{3}/_{16}$	·924	·076
,,	—	,,	$0\frac{1}{2}$	,,	=	$22\ ^{2}/_{16}$	·921	·079
,,	—	,,	$0\frac{1}{4}$	,,	=	$22\ ^{1}/_{16}$	·919	·081
Standard					=	22	·916$^{2}/_{3}$	·084
Worse	1	carat			=	21	·875	·125
,,	2	,,			=	20	·833$^{1}/_{3}$	·167
,,	3	,,			=	19	·791$^{2}/_{3}$	·209
,,	4	,,			=	18	·750	·250
,,	5	,,			=	17	·708$^{1}/_{3}$	·292
,,	6	,,			=	16	·666$^{2}/_{3}$	·334
,,	7	,,			=	15	·625	·375
,,	8	,,			=	14	583$^{1}/_{3}$	·417
,,	9	,,			=	13	·541$^{2}/_{3}$	·459
,,	10	,,			=	12	·500	·500
,,	11	,,			=	11	·458$^{1}/_{3}$	‘542
,,	12	,,			=	10	·416$^{2}/_{3}$	·584
,,	13	,,			=	9	·375	·625
,,	14	,,			=	8	·333$^{1}/_{3}$	·667
,,	15	,,			=	7	·291$^{2}/_{3}$	·709
,,	16	,,			=	6	·250	·750
,,	17	,,			=	5	·208$^{1}/_{3}$	·792
,,	18	,,			=	4	·166$^{2}/_{3}$	·834
,,	19	,,			=	3	·125	·875
,,	20	,,			=	2	·083$^{1}/_{3}$	·917
,,	21	,,			=	1	·041$^{2}/_{3}$	·959
,,	21	,,	$3\frac{3}{4}$	gr.	=	$0^{15}/_{16}$	·039	·961
,,	21	,,	$3\frac{1}{2}$	,,	=	$0^{14}/_{16}$	·036$^{2}/_{3}$	·964
,,	21	,,	$3\frac{1}{4}$	,,	=	$0^{13}/_{16}$	·034	·966
,,	21	,,	3	,,	=	$0^{12}/_{16}$	·031$^{1}/_{3}$	·969
,,	21	,,	$2\frac{3}{4}$	,,	=	$0^{11}/_{16}$	·028$^{2}/_{3}$	·972
,,	21	,,	$2\frac{1}{2}$	,,	=	$0^{10}/_{16}$	·026	·974
,,	21	,,	$2\frac{1}{4}$	,,	=	$0\ ^{9}/_{16}$	·023$^{1}/_{3}$	·977
,,	21	,,	2	,,	=	$0\ ^{8}/_{16}$	·020$^{2}/_{3}$	·980
,,	21	,,	$1\frac{3}{4}$	,,	=	$0\ ^{7}/_{16}$	·018$^{1}/_{3}$	·982
,,	21	,,	$1\frac{1}{2}$	,,	=	$0\ ^{6}/_{16}$	·015$^{2}/_{3}$	·985
,,	21	,,	$1\frac{1}{4}$	,,	=	$0\ ^{5}/_{16}$	·013	·987
,,	21	,,	1	,,	=	$0\ ^{4}/_{16}$	·010$^{1}/_{3}$	·990
,,	21	,,	$0\frac{3}{4}$	,,	=	$0\ ^{3}/_{16}$	·008	·992
,,	21	,,	$0\frac{1}{2}$	,,	=	$0\ ^{2}/_{16}$	·005$^{1}/_{3}$	·995
,,	21	,,	$0\frac{1}{4}$	,,	=	$0\ ^{1}/_{16}$	·002$^{2}/_{3}$	·998
,,	21	,,	$0\frac{1}{8}$	,,	=	$0\ ^{1}/_{32}$	·001$^{1}/_{3}$	·999

Millemes converted into Carats fine in Gold Assay Reports.

Milli.		Car.	Qtr. gr. or $^{1}/_{16}$ car.	Milli.		Car.	Qtr. gr. or $^{1}/_{16}$ car.
1·000	=	24	———	·040	=	—	15·360
·900	=	21	9·600	·030	=	—	11·520
·800	=	19	3·200	·020	=	—	7·680
·700	=	16	12·800	·010	=	—	3·840
·600	=	14	6·400	·009	=	—	3·456
·500	=	12	—	·008	=	—	3·072
·400	=	9	9·600	·007	=	—	2·688
·300	=	7	3·200	·006	=	—	2·304
·200	=	4	12·800	·005	=	—	1·920
·100	=	2	6·400	·004	=	—	1·536
·090	=	2	2·560	·003	=	—	1·152
·080	=	1	14·720	·002	=	—	0·768
·070	=	1	10·880	·001	=	—	0·384
·060	=	1	7·040	·000$^{2}/_{3}$	=	—	0·256
·050	=	1	3·200	·000$^{1}/_{3}$	=	—	0·128

Value of Fine Gold, calculated to Milliemes of an ounce.

		£	s.	d.			s.	d.
Per	1 oz.	4	5	0	Per	·050 oz.	4	3
,,	·900	3	16	6	,,	·040 ,,	3	5
,,	·800	3	8	0	,,	·030 ,,	2	6½
,,	·700	2	19	6	,,	·020 ,,	1	8
,,	·600	2	11	0	,,	·010 ,,	0	10
,,	·500	2	2	6	,,	·009 ,,	0	9
,,	·400	1	14	0	,,	·008 ,,	0	8
,,	·300	1	5	6	,,	·007 ,,	0	7
,,	·200	0	17	0	,,	·006 ,,	0	6
,,	·100	0	8	6	,,	·005 ,,	0	5
,,	·090	0	7	8	,,	·004 ,,	0	4
,,	·080	0	6	9	,,	·003 ,,	0	3
,,	·070	0	5	11	,,	·002 ,,	0	2
,,	·060	0	5	1	,,	·001 ,,	0	1

(To be Continued.)

CHATWOOD'S "INVINCIBLE" SAFES

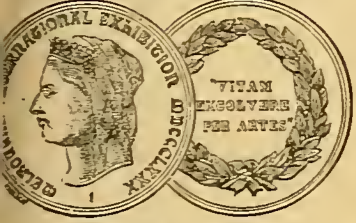
HIGHEST AWARDS ALL EXHIBITIONS

GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST E.C.

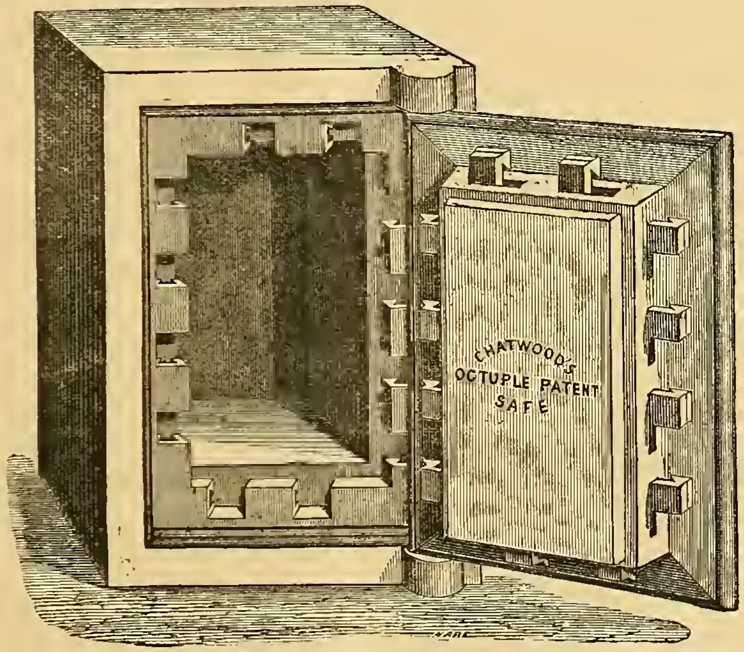
MELBOURNE
International
Exhibition.
1880-1.

SPECIAL
GOLD MEDAL


INTERNATIONAL EXHIBITION
MELBOURNE
MDCCCLXXX
"VITAM EXCOLVERE PER ARTES"

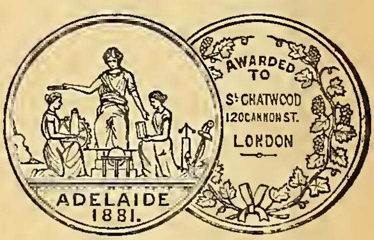
AND
THREE FIRST
ORDERS OF MERIT.

120,
CANNON STREET,
LONDON.
22, BOND STREET,
LEEDS.


CHATWOOD'S
OCTUPLE PATENT
SAFE

ADELAIDE
International
Exhibition.
1881.

SPECIAL
GOLD MEDAL


ADELAIDE
1881.
AWARDED TO
S^t CHATWOOD
120 CANNON ST.
LONDON

AND
THREE FIRST
DEGREES OF MERIT.

11,
CROSS STREET
MANCHESTER.
WORKS: BOLTON.

CHATWOOD'S "INVINCIBLE" SAFES

HIGHEST AWARDS ALL EXHIBITIONS

GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST E.C.

ENGLISH *v.* FOREIGN MANUFACTURE.

So much has been heard lately about the improvement in workmanship abroad and of its deterioration here, that it is gratifying to find an instance where England has fully maintained her old pre-eminence. The Dutch papers just to hand contain reports of the trial of an English safe, which was brought about somewhat strangely. It appears that some time since there was at Arnhem an international exhibition under the authority of the Government of the Netherlands. Among the objects intended to be tested, and for which medals and rewards were offered, were safes. The conditions of competition were prepared by authority, and they stated that a safe was wanted that should be at once fire-proof, fall-proof, and burglar-proof. A gold medal and a money prize was offered to the most successful maker, and a silver medal and a smaller money prize to the second. Mr. Samuel Chatwood, the well-known English safe manufacturer, determined to compete for the prize, and made a safe to answer the conditions imposed. It happened, however, that the Netherlands Minister of Commerce asked him to assist on the jury; he was elected president, and that made competition on his part impossible. There were twelve competitors; nine of them were Dutch and three German. The first hour's fire over, the fall test followed, and two of the safes were utterly broken, and so placed *hors de combat.* The remaining ten went through the second fire test, and it was afterwards found that in each the papers inside were charred. Two workmen, with a set of ordinary burglar forcing tools, undertook the burglar's task, and opened all the ten safes in twelve hours. No safe withstood their attack for four hours, while one was opened in less than five minutes. There were complaints, and several of the safe-makers and others interested said openly that the conditions of trial were such that no safe could stand. On this Dr. Bosscha, the president of the international grand jury, asked Mr. Chatwood if he would consent to his safe being submitted to the same tests. He consented, and the trials took place on the 20th of December at Amsterdam.

The announcement caused considerable excitement among the safe-makers on the Continent. M. Van der Maden, the Director of the royal factory for the making of steam and other engines, found the space on which the trials were to take place. On Saturday morning, the 20th December, a goodly number of people assembled, and before the firing test began there were present many of the principal inhabitants of Amsterdam, including members of the Government, of the Town Council, of the Army and Navy, as well as of merchants and manufacturers. Almost all the safe-makers who competed at Arnhem were there to see how this English safe would bear itself under the conditions which led to their easy defeat. Four brick pillars were built on a circular brick base, and on these the safe was placed, the hauling being done by a powerful crane resting on huge shears. The safe was 5ft. high, 2ft. 7½in. wide, and 2ft. 2½in. deep; it weighed 2 tons. As soon as it stood in its place, several men heaped about it plenty of wood in large and small pieces, and then started the fire. Before it had burned ten minutes, the fuel reached to and lay on the top of the safe, and so intense was the heat that the hundreds of people about were forced to keep their distance, and a small fire engine was called into requisition to play on the shears and save them from combustion. After burning an hour the safe was lifted to the height of twenty feet and pulled over a stone-laid floor for the second or fall trial. This trial was more severe than was intended, for before the men were ready the slip-hook was accidentally released, and the safe came down with a tremendous thud on the stones, breaking and sinking them into the hard frozen ground. No effect of any kind was produced on the safe, and it was again subjected to fire for three hours longer. Here again the test was more severe than at Arnhem, for while there only eight cubic yards of wood were used as fuel, at Amsterdam twelve cubic yards were burned. There was much speculation as to the condition of the safe, most of the safe-makers present being convinced that the fire test had been too much for it.

On the Monday morning the interest seemed to have increased, as there was again a large assembly of people to see the lifting of the safe and the placing of it in a shed to be submitted to the burglar-proof test. The jury had invited the competitors of Arnhem to select two of the most skilled workmen they knew to undertake this, but they all declined, notwithstanding the fact that Mr. Chatwood offered a reward of 100 gulden to the workmen who succeeded in opening the safe. Under these circumstances M. Van der Maden found two, one of them having been a safe-maker for twelve years. They were complimented all round on the skill they displayed in finding points of attack. They had brought their own tools with them, and were permitted to use them or those which were used at Arnhem. They elected to use the latter set, weighing 56 lb. They set to work, but after two hours' hard labour gave up, saying they had broken all their chisels and bars. Mr. Chatwood then consented that they should use also the tools they themselves had brought, another weight of 56 lb. They set to again, but were just as much foiled. All the time they were at work some of the safe-makers stood close by, and were continually making suggestions.

This failure being complete, Mr. Chatwood resolved to try to open the safe, so as to get at the contents, by machinery next day. At five minutes to ten the next morning, after drawing the safe to its place under a powerful radial steam drilling machine, the men commenced to drill out the stud bolts of the door, under Mr. Chatwood's superintendence. The working drawings not being at hand, the exact position of these studs could not be told, which necessitated the drilling of three holes for one stud and two holes for another in the bottom of the door. During the time this drilling was going on the machine was running at its highest power. After this, at Mr. Chatwood's request, an attempt was made to drill out the lock. The attempt proved futile on account of the point of the drill coming into contact with the hard metal intersection between the lock and the outer door. After placing considerable power on the drill it was withdrawn. The point of the drill was found completely rounded off in the attempt to get through the hard metal. After all the studs were drilled out, and therefore the actual holding power of the door was gone, an attempt was made to prise open the outer door by means of sets and heavy sledges. This, however, proved completely unsuccessful. The safe was then turned on the side on which the hinges were, and two large holes drilled on this side by the radial drill. After this, by means of large steel drifts and a further application of the crowbars, the door was at length opened. This was not until about four o'clock, and many men had been employed. A change of hands for the hammers was employed throughout, about ten of the best men in the works being told off for the duty. The interior door was opened by its own keys after a delay of about twenty minutes, the delay being occasioned by the bolts having become rusted into their holes by the condensation of steam during the fire proof. On the door being opened the papers were found in every respect in as good condition as when put in the safe before the fire test.

The trials were under the special direction of Dr. J. Bosscha, Director of the Polytechnic School of Delft; Ph. Lindo, Director of the Cement Factory, Delft; H. A. Raveneck and J. G. Snijders, Professors of the Polytechnic School, Delft; H. L. Woltersom, Civil Engineer, Arnhem—these being the president, secretary, and members of the jury for the international concours held at Arnhem. These gentlemen have signed and issued an official report, in which they state that the safe stood each test perfectly; that all the documents in the safe were uninjured, writing and printing being exactly as when placed inside; and they further say—"On the strength of these trials, the undersigned judge that the requisites demanded in the Arnhem programme and tests for a safe constructed on proper principles have proved by no means too severe for the safe of Mr. Chatwood; nay, that in all probability Mr. Chatwood's safe would have stood a severer test for fire, falling, and burglary."—From the *Morning Post*, January 10, 1880.

Bronzes.

By C. D. E. Fortnum, F.S.A.

(Continued from page 65.)

In Germany, Schadon (1764-1850) executed works of independent character, for the most part or all in marble, some of which have since been reproduced in bronze. Christian Rauch, also of Berlin, made some portrait statues, in bronze, of which one to Blücher, designed by Schadow, is at Breslau, and was finished in 1820. Another in the same material is at Berlin, executed in 1826, with bas-reliefs upon the base. But his most important work is the grand equestrian statue of Frederick the Great (1839-1851) with its richly adorned pedestal, so conspicuous an object at Berlin; of which there is a reduced copy in the South Kensington Museum (No. 976—'72). Friedrich Drake, Rauch's pupil, ably followed his master's manner.

A notable but somewhat exaggerated bronze work by A. Wolff is on the staircase of the Berlin Museum, a mounted youth attacked by a lion; it forms a corresponding group to the Amazon, by August Kiss, and is of greater merit. This artist has produced many important works in bronze, among which we may note the equestrian monuments to Frederick William III., at Königsberg and Breslau. The more generally known groups are those of St. Michael and of St. George and the Dragon; works of amazing power somewhat overstrained. Ludwig Schwanthaler (1802-48), the leader of the Munich school, worked chiefly at that city, after completing his studies in Italy. He has produced many works in bronze; the colossal figure of Bavaria, fifty-four feet high, being very remarkable for its size. Of Schivanthaler's school are some bronze statues in Munich, in questionable taste, such as those in the Maximilian Strasse, and that of the elector Max Emmanuel on the promenade. An equestrian statue to king Ludwig is by another hand, that of Widnmann. More recent and of more importance are the bronze doors for the Capitol at Washington, cast by F. V. Müller, of Munich, after designs by Randolph Rogers.

After the long-continued occupation of Gaul by the Romans, an occupation that left a much stronger impress upon the arts and habits of the people than that produced in Germany or England, a period intervenes, of the productions of which we have but few characteristic remains. The Franks and Gauls, during those troubled centuries, were still influenced by reminiscences of the classic manner; occasionally by being slightly intermingled with that of the Byzantines. Not, indeed, until the Merovingian age do we find any distinct style of metal working supervening upon the debased Roman, which, for the sake of distinction, is usually classed as "Gallo-roman,"

In Merovingian works, both of bronze and of the precious metals, we find a divergence from classic models and a method of ornamentation of somewhat oriental taste, in personal ornaments, &c.; combining the celtic filigree interlacings, with Teutonic forms, and an enrichment by means of coloured glass or stones, separated by *cloisons* or thin walls of the metal, somewhat like the antique Egyptienne and the Byzantine. Again, the gold, silver, and gilded bronze fibulæ, and other ornaments for dress, weapons, &c., discovered in France, approach so closely to the character of those found in the Saxon graves of England, in the Lombardic sepulchres of Italy, and in Spain, that it is difficult to draw a line of difference between the productions of these several peoples.

The use of enamel on bronze has been already alluded to in reference to the works in that alloy of the later Celtic period in Britain; and objects of similar ornamentation, which would seem to have had a northern origin, are also found in Gaul and in Germany. The Merovingian and Saxon manner is more distinctly *cloisonne*, and effected by the insertion of slices cut from rods of red or many coloured glass or stones, rather than by the fusion of the powdered enamel.

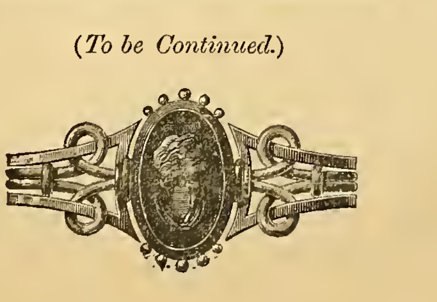
Bronze, however, being our proper subject, we must resist the being detained by an enquiry into the process of enamel enrichment of the metal. The art of enamelling in France, gathered its forces together in the great centre at Limoges, a place already celebrated for its metal workers, even in classic times, and where they continued to flourish under the master hand of Abbon, followed by his more celebrated pupil Eloy. Received into court favour, and afterwards created bishop, the latter admirable artist still continued to practise the work he so much loved, and established at Solignac, in A.D. 631, a monastery for artistic monks, which became a school of ecclesiastical metal work. The gilt bronze chair preserved at Paris, and known as that of Dagobert, has been ascribed from early time to Eligius or Eloy, the patron of the craft in France; but (the history given by S. Ouen notwithstanding) it is possibly more ancient, or at most a copy of a Roman curule chair, to which additions and alterations have been made; perhaps by Suger (who refers to it as the work of Eloy) in the twelfth century. A cast of it is in the South Kensington Museum (No. '68.-16).

The Carlovingian still retained the forms of debased Roman art, as may be seen in the bronze *grilles*, the lion-mask door, rings, &c., at the cathedral of Aix-la-Chapelle; but the goldsmith's work upon Charlemagne's sword and crown, though rude in modelling, partakes of a Byzantine character; and other metal-work of the period would seem to exhibit rather a barbaric display of rich material than originality in design or masterly execution. The Byzantine manner is strongly marked in all the earlier productions of Limoges. Meanwhile, in France, sculpture was applied to ivory and to stone rather than to metal, and larger castings in bronze are almost unknown.

Suger, abbot of St. Denis, was the leading spirit of art during the early half of the twelfth century. He rebuilt the abbey of St. Denis, and is said to have introduced bronze-casting (probably by the immigration of Byzantine artists), causing to be cast for it, about 1140, the first pair of gilt bronze doors that had been produced in France. They were enriched with *relievos* representing the history of the Passion, the Resurrection, and the Ascension. These still existed in 1706. Suger was also a great restorer, and in so doing probably injured many previously existing works; for example, he re-gilded and re-enamelled the candelabra given to the Abbey by Charlemagne, and the eagle at that time in the choir.

From 1100 to 1400 the industrious artists of Limoges continued to produce large monuments, chasses, church vessels, candelabra, &c., of gilt and enamelled copper; but their work gradually declined during the troublous times of the fourteenth century, and eventually ceased, until again resumed in another form under the influence of Francis I., in the sixteenth century, and by the master-hand of Leonard Limousin.

(To be Continued.)



My Watch.

MARK TWAIN.

MY beautiful new watch had run eighteen months without losing or gaining, and without breaking any part of its machinery or stopping. I had come to believe it infallible in its judgments about the time of day, and to consider its constitution and its anatomy imperishable. But at last, one night, I let it run down. I grieved about it as if it were a recognised messenger and forerunner of calamity. But by-and-by I cheered up, set the watch by guess, and commanded my bodings and superstitions to depart. Next day I stepped into the chief jeweller's to set it by the exact time, and the head of the establishment took it out of my hand and proceeded to set it for me. Then he said, "She is four minutes slow—regulator wants pushing up." I tried to stop him—tried to make him understand that the watch kept perfect time. But no; all this human cabbage could see was that the watch was four minutes slow, and the regulator *must* be pushed up a little; and so, while I danced around him in anguish, and beseeched him to let the watch alone, he calmly and cruelly did the shameful deed. My watch began to gain. It gained faster and faster day by day. Within the week it sickened to a raging fever, and its pulse went up to one hundred and fifty in the shade. At the end of two months it had left all the time-pieces of the town far in the rear, and was a fraction over thirteen days ahead of the almanack. It was away into November enjoying the snow, while the October leaves were still turning. It hurried up house-rent, bills payable, and such things, in such a ruinous way that I could not abide it.

I took it to the watchmaker to be regulated. He asked me if I ever had it repaired. I said, No, it had never needed any repairing. He looked a look of vicious happiness and eagerly prised the watch open, then put a small dice-box into his eye and peered into its machinery. He said it wanted cleaning and oiling, besides regulating—come in a week. After being cleaned and oiled and regulated, my watch slowed down to that degree that it ticked like a tolling bell. I began to be left by trains, I failed all appointments, I got to missing my dinner; my watch strung out three days' grace to four, and let me go to protest; I gradually drifted back into yesterday, then day before, then into last week, and by-and-by the comprehension came upon me that all solitary and alone I was lingering along in week before last, and the world was out of sight. I seemed to detect in myself a sort of sneaking fellow-feeling for the mummy in the museum, and a desire to swop news with him.

I went to a watchmaker again. He took the watch all to pieces while I waited, and then said the barrel was "swelled." He said he could reduce it in three days. After this the watch *averaged* well, but nothing more. For half a day it would go like the very mischief, and keep up such a barking and wheezing, and whooping, and sneezing and snorting, that I could not hear myself think for the disturbance; and as long as it held out there was not a watch in the land that stood any chance against it. But the rest of the day it would keep on slowing down and fooling along until all the clocks it had left behind caught up again. So at last, at the end of twenty-four hours, it would trot up to the judges' stand all right and just in time. It would show a fair and square average, and no man could say it had done more or less than its duty. But a correct average is only a mild virtue in a watch, and I took this instrument to another watchmaker. He said the kingbolt was broken. I said I was glad it was nothing more serious. To tell the plain truth, I had no idea what the kingbolt was, but I did not choose to appear ignorant to a stranger. He repaired the kingbolt, but what the watch gained in one way it lost in another. It would run a while and then stop a while, and then a while again, and so on, using its own discretion about the intervals. And every time it went off it kicked back like a musket.

I padded my breast for a few days, but finally took the watch to another watchmaker. He picked it all to pieces and turned the ruin over and over under his glass; and then he said there appeared to be something the matter with the hair-trigger. He fixed it, and gave it a fresh start. It did well now, except that always at ten minutes to ten the hands would shut together, like a pair of scissors, and from that time forth they would travel together.

The oldest man in the world could not make head or tail of the time of day by such a watch, and so I went again to have the thing repaired. This person said that the crystal had got bent, and that the mainspring was not straight. He also remarked that part of the works needed half-soling. He made these things all right, and then my timepiece performed unexceptionably, save that now and then, after working along quietly for nearly eight hours, everything inside would let go all of a sudden and begin to buzz like a bee, and the hands would straightway begin to spin round and round so fast that their individuality was lost completely, and they simply seemed a delicate spider's web over the face of the watch. She would reel off the next twenty-four hours in six or seven minutes, and then stop with a bang.

I went with a heavy heart to one more watchmaker, and looked on while he took her to pieces. Then I prepared to cross-question him rigidly, for this thing was getting serious. The watch had cost two hundred dollars originally, and I seemed to have paid out two or three thousand for repairs. While I waited and looked on I presently recognised in this watchmaker an old acquaintance—a steamboat engineer of other days, and not a good engineer either. He examined all the parts carefully, just as the other watchmakers had done, and then delivered his verdict, with the same confidence of manner. He said—

"She makes too much steam—you want to hang the monkey-wrench on the safety-valve!"

I brained him on the spot, and had him buried at my own expense.

My uncle William (now deceased, alas!) used to say that a good horse was a good horse until it had run away once, and that a good watch was a good watch until the repairers got a chance at it. And he used to wonder what became of all the unsuccessful tinkers, and gun-smiths, and shoemakers, and blacksmiths; but nobody could ever tell him.—*The A1 Reader*.

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BRITISH HOROLOGICAL INSTITUTE,

Northampton Square, Clerkenwell.

A Class on Theoretical Horology and Mechanics, for preparing Students to pass the City and Guilds of London Examination in Watchmaking, is held on Monday evenings, from 8 till 9.30, and on Friday evenings, from 5.30 till 7 o'clock, under the direction of Mr. T. D. Wright. Others than Members of the Institute may attend this class for the Winter Course, on payment of 5s. Applications to be made to the Secretary. The full Educational Programme of the Institute is published in the *Horological Journal* for December.

John Harrison, Chronometer Maker.

AT the Royal Observatory, Greenwich, one of the most remarkable instruments is to be seen—the first chronometer, the parent of a numerous progeny of chronometers, used on board of every sea-going ship, to the advantage of navigation, of commerce, as well as of science. As far back as the reign of Queen Anne, in the year 1714, the English Government offered the large prize of £20,000 to the person who should find the method of discovering the longitude at sea, within certain specified limits. The reward was offered to the world, to inventors and scientific men of all countries, without any restriction of nation, or race, or language. To the surprise of everyone—it was thought remarkable, and it *was* remarkable—the prize was won by a man who had been brought up as a village carpenter, of no school, or college, or university. But the truth is that the great mechanic, like the poet, is born, not made; and John Harrison, the winner of the famous prize, was a born mechanic. He did not, however, accomplish his object without the exercise of the greatest skill, patience, and perseverance. Indeed, his life, so far as we can ascertain the facts of it, is one of the finest examples of difficulties overcome, and of undaunted perseverance eventually crowned by success, in the whole range of biography.

No complete narrative of Harrison's career was ever written. Only a short notice of him appears in the "Biographica Britannica," published in 1766, during his lifetime,—the facts of which were obtained from himself. A few notices of him appear in the "Annual Register," also published during his lifetime. But no Life of him has since appeared. Had he won battles by land or sea, we should have had biographies of him without end. But he pursued a more peaceful and industrious course. His discovery conferred an incalculable advantage on navigation, and enabled innumerable lives to be saved at sea: it also added to the domains of science by its more exact measurement of time. But his memory has been allowed to pass silently away, without any record being left for the benefit and advantage of those who have succeeded him. The following memoir includes nearly all that is known of the life and labours of John Harrison.

He was born at Foulby, in the parish of Wragby, near Pontefract, Yorkshire, in May 1693. His father, Henry Harrison, was carpenter and joiner to Sir Rowland Wynne, owner of the Nostel Priory estate. The present house was built by the baronet on the site of the ancient priory. Henry Harrison was a sort of retainer of the family, and he long continued in their service.

Little is known of the boy's education. It was certainly of a very inferior description. Like George Stephenson, Harrison had always a great difficulty in making himself understood, either by speech or writing. Indeed, every board school boy receives a better education now than John Harrison did a hundred and eighty years ago. But education does not altogether come by reading and writing. The boy was possessed of vigorous natural abilities. He was especially attracted by every machine that moved *upon wheels*. The boy was thus "father to the man." When six years old, and lying sick of small-pox, a going watch was placed upon his pillow, which afforded him infinite delight.

When seven years old he was taken by his father to Barrow, near Barton-on-Humber, where Sir Rowland Wynne had another residence and estate. Henry Harrison was still acting as the baronet's carpenter and joiner. In course of time young Harrison joined his father in the workshop, and proved of great use to him. His opportunities for acquiring knowledge were still very few, but he applied his powers of observation and his workmanship to the things that were nearest him. He worked in wood, and to wood he first devoted his attention.

He was still fond of machines going upon wheels. He had enjoyed the sight of the big watch going upon brass wheels when he was a boy; but, now that he was a workman in wood, he proposed to make a time-keeper with wheels of that material. After many difficulties—and nothing can be accomplished without them—he succeeded in making a wooden clock, with wheels of wood. This, however, was only a beginning. He proceeded to make better clocks; and then he found it necessary to introduce metal, as being more lasting. He made pivots of brass, which moved more conveniently in sockets of wood, with the use of oil. He also caused the teeth of his wheels to run against cylindrical rollers of wood, fixed by brass pins, at a proper distance from the axis of the pinions; and thus to a considerable extent he removed the inconveniences of friction.

In the meantime Harrison eagerly improved every incident from which he might derive further information. There was a clergyman who came every Sunday to the village to officiate in the neighbourhood; and having heard of the sedulous application of the young carpenter, he lent a manuscript copy of Professor Saunderson's discoveries. The blind professor had prepared several lectures on natural philosophy for the use of his students, but they were never intended for publication. Young Harrison now proceeded to copy them out, together with the diagrams Sometimes, indeed, he spent the greater part of the night in writing or drawing.

As part of his business, he undertook to survey land, and to repair clocks and watches, besides carrying on his trade of a carpenter. He soon obtained a considerable knowledge of what had been done in clocks and watches, and was able to do not only what the best professional workers had done, but to strike out entirely new light in the clock and watch-making business. He found out a method of diminishing friction by adding a joint to the pallets of the pendulum, whereby they were made to work in the nature of rollers of a large radius, without any sliding, as usual, upon the teeth of the wheel. He constructed a clock on the recoiling principle, which went perfectly and never lost a minute within fourteen years. Sir Edmund B. Denison says that he invented this method in order to save himself the trouble of going so frequently to oil the escapement of a turret clock, of which he had charge; though there were other influences at work besides this.

But his most important invention, at this early period of his life, was his compensation pendulum. Everyone knows that metals expand by heat and contract with cold. The pendulum of the clock therefore expanded in summer and contracted in winter, thereby interfering with the regular going of the clock. Huygens had by his cylindrical checks removed the great irregularity arising from the unequal lengths of the oscillations; but the pendulum was affected by the tossing of a ship at sea, and was also subject to a variation in weight, depending on the parallel of latitude. Graham, the well-known clockmaker, invented the mercurial compensation pendulum, consisting of a glass or iron jar filled with quicksilver and fixed to the end of the pendulum rod. When the rod was lengthened by heat, the quicksilver and the jar which contained it were simultaneously expanded and elevated, and the centre of oscillation was thus continued at the same distance from the point of suspension.

But the difficulty, to a certain extent, remained unconquered until Harrison took the matter in hand. He observed that all rods of metal do not alter their lengths equally by heat, or, on the contrary, become shorter by cold, but some more sensibly than others. After innumerable experiments Harrison at length composed a frame somewhat resembling a gridiron, in which the alternate bars were of steel and of brass, and so arranged that those which expanded the most were counteracted by those which expanded the least. By this means the pendulum contained the power of equalising its own action, and the centre of oscillation continued at the same absolute distance from the point of suspension through all the variations of heat and cold during the year.

Thus by the year 1726, when he was only twenty-three years old, Harrison had furnished himself with two compensation clocks, in which all the irregularities to which these machines were subject were either removed or so happily balanced, one metal against the other, that the two clocks kept time together in different parts of his house, without the variation of more than a single second in the month. One of them, indeed, which he kept by him for his own use, and constantly compared with a fixed star, did not vary so much as one minute during the ten years that he continued in the country after finishing the machine.

Living, as he did, not far from the sea, Harrison next endeavoured to arrange his timekeeper for purposes of navigation. He tried his clock in a vessel belonging to Barton-on-Humber; but his compensating pendulum could there be of comparatively little use; for it was liable to be tossed hither or thither by the sudden motions of the ship. He found it necessary, therefore, to mount a chronometer, or portable timekeeper, which might be taken from place to place, and subjected to the violent and irregular motion of a ship at sea, without affecting its rate of going. It was evident to him that the first mover must be changed from a weight and pendulum to a spring wound up and a compensating balance.

He now applied his genius in this direction. After pondering over the subject in his mind, he proceeded to London in 1728, and exhibited his drawings to Dr. Halley, then Astronomer Royal. The Doctor referred him to Mr. George Graham, the distinguished horologer, inventor of the dead-beat escapement. After examining the drawings and holding some converse with Harrison, Graham perceived him to be a man of uncommon merit, and gave him every encouragement. He recommended him, however, to make his machine before again applying to the Board of Longitude. He accordingly returned home to Barrow to complete his task, and many years elapsed before he again appeared in London to present his chronometer.*

(*To be continued.*)

Trade Notes.

On Thursday, December 14th, at eight o'clock, Mr. Henry Ganney will open a discussion at the Horological Institute, Northampton Square, on the desirability of prohibiting London Trade Marks on Foreign Watch and Clock work.

The last day for the deposit of chronometers at the Royal Observatory, for the forthcoming annual trial, will be Monday, January 8th, 1883.

A silver cradle, in the form of a canoe, resting on a silver centre, has been presented to Sir Edward and Lady Cowan, the Mayor and Mayoress of Belfast. The cost of the present amounts to about £300, and it is given in accordance with a custom of the city, a son having been born to his worship during his year of office.

Artificial turquoise are made in Paris and Vienna that cannot be distinguished by external appearances from the natural product, and when artistically made can only be distinguished by means of the file, being usually softer. They are made from phosphate of alumina and phosphate of copper mixed together and subjected to hydraulic pressure. Even in chemical composition it resembles the natural mineral. which is a hydrated phosphate of alumina, with two per cent. of oxide of copper.

P. Weiskopf has given in the *Diamant* the following formulæ for the frit or mass used in Bohemia for making imitations of some of the precious stones:—Imitation agates: 10 kilos. quartz, 17 kilos. red lead, 3·2 kilos. potash, 2·2 kilos. borax, and 0·1 kilo. arsenic. The quantity of chloride of gold added is equal to that obtained from 0·4 of a ducat. Agate glass: 10 parts of broken glass are melted, and to it are added 0·15 part suboxide of copper, the same quantity of the oxides of chromium and of manganese, 0·02 part each of oxide of cobalt and nitrate of silver, 0·01 oxide of uranium, 0·4 red argols, 0·3 part bone meal. Each oxide is added alone and at intervals of ten minutes. After heating the mixture for an hour, 0·3 or 0·4 part of fine soot is put in. Red marble: 80 parts of sand, 40 of potash, 10 of lime, 2 of table salt, 1 of saltpetre, and 0·1 of arsenic. The mixture is melted, and then 25 parts of suboxide of copper and 1 part of saltpetre mixed in.

It is a common practice to describe the present as an age of shams, especially in relation to many manufactured articles. But the experience of a lady of title, who wished the other day to dispose of some handsome jewellery, presented to distinguished ancestors, male and female, by very illustrious personages, shows (says the *Court Journal*) that the art of shamming was carried to a very high degree in the days of our grandfathers and grandmothers. The lady in question, desiring to dispose of these precious and honoured objects, consulted a well-known jeweller. Producing from a velvet and emblazoned case a superb set of rubies, she enquired what sum could be obtained for them, remarking at the same time upon their magnificent appearance, both as to the colour of the stones and the setting. The jeweller examined them carefully, and said, "They are certainly very showy, madam, but unfortunately they are not genuine stones. They are, in fact, clever imitations in glass." The lady, much chagrined, then called attention to the heavy settings, to which the jeweller replied, after the usual tests, "The setting, madam, is only gilt!" Another article produced for appraisement was a superb bracelet, the gift of a Continental sovereign to the wife of a distinguished diplomatist. The skilful manufacture and specific gravity of this splendid object had been extolled for generations in the family of the possessor, and so highly prized that it was invariably sent to the bankers when the family went out of town. The jeweller scrutinized it carefully, and pronounced it to be extremely heavy; "but," he added, "if you will allow me to raise this very thin plate, I shall be able to show you that the bracelet is filled up with lead!" The lady of title was so much shocked that she declined to submit any more articles to this candid and able judge.

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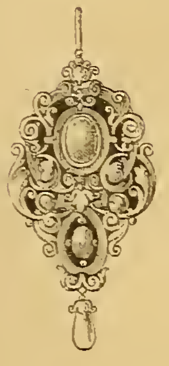
* From an article by Samuel Smiles in "Longman's Magazine."

Supplement to the Watchmaker, Jeweller, and Silversmith, January 5th, 1883.

MONTHLY SUPPLEMENT OF DESIGNS.



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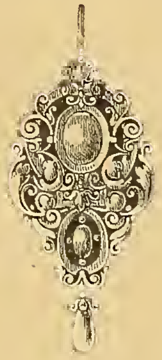

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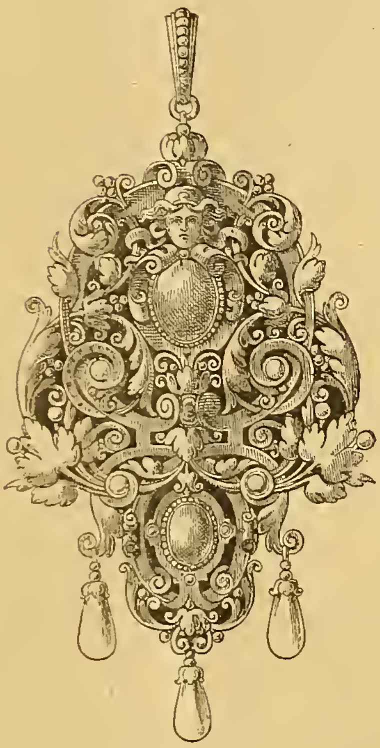

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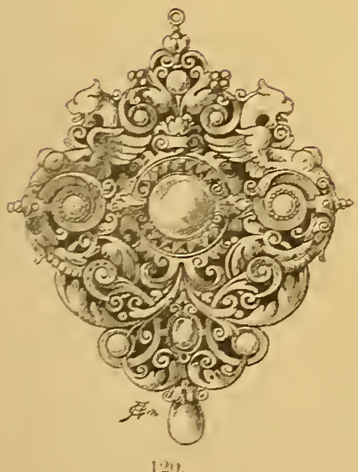

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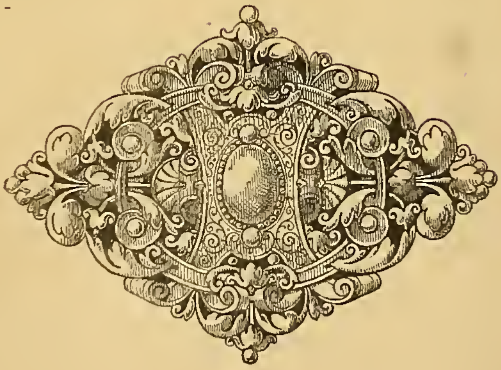

121.

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

No. 92.—Vol. VIII.] JANUARY 5, 1883. [Subscription, 5s. per Annum. Post Free.

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ILLUSTRATED SUPPLEMENT :—Designs for Modern Jewellery.

Our National Watch Factory.

By a Horological Zadkiel.

(Continued from page 68.)

The mention of the cases naturally leads to the description of the kind of movements they contained; and it is, perhaps, needless to say that the great majority were made on the going-barrel principle: but the time-honoured fusee and chain were by no means discarded, as they commanded a sale in certain markets.

Beyond the fact that smaller and more elegant watches had been produced than had hitherto been thought possible for the capacities of our workpeople, the company did not profess to have introduced anything startlingly new in the method of manufacturing. What they relied on was the superior finish of their goods, in consequence of their being in possession of the most recently-invented machines for horological purposes, and also their ability to obtain an unlimited supply of the very best hand labour.

Unlike the American Watch Company, of Waltham, Mass., which claimed to produce every part of the watch at their own factory, they freely availed themselves of the assistance afforded by both Clerkenwell and Lancashire; and by ordering movements and internal parts in large quantities, were enabled to secure a uniformity of construction, which was beyond the powers of small makers working in an isolated manner.*

An absolute necessity existed for this proceeding, in consequence of the great change which had come over the trade in the last few years. The older practical men were withdrawing their capital from it by degrees, while the younger found it more profitable to engage in buying and selling instead of manufacturing; consequently, the English trade proper was being starved out for want of capital and co-operation, and many really good workmen were reduced to sore straits.

Under these circumstances, several public meetings were held in Clerkenwell, which were attended by the members for Finsbury; also those for the newly-created boroughs of Islington and Wandsworth; and an attempt was made to induce the Government to offer special advantages to an undertaking such as the National Watch Factory; but the matter was referred to the Board of Trade officials, who strongly deprecated any such help being given, and maintained that the best way of encouraging a British industry was to give foreign competitors every possible facility of introducing their goods. On its being urged that the greater part of the said goods were made to resemble English, and were also extensively stamped with our official marks, they replied in effect that "imitation was the sincerest form of flattery," and as long as their own returns kept up, they did not intend to trouble themselves with mere matters of detail.

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* See September number.

Thus rebuffed, the leaders of the demonstration had to fall back on their own resources, which some said was the best thing for them.

Valuable help was rendered by the *Watchmaker, Jeweller, and Silversmith,* which, unfettered as it was by official restraints, attained a position beyond that of any ordinary trade journal, and became an acceptable medium of information on general topics.

Lectures were delivered by Mr. J. Turner Pivot, under influential patronage, as it was felt by many that it was of paramount importance that the highest mechanical art of a country which had made its position by its manufactures ought, if possible, to be prevented from leaving it.

Without recapitulating details already given, it is sufficient to say that Jonathan now found himself inspecting the outcome of all these efforts.

The directors anticipated that the building would require enlarging and re-constructing in about two years, much of it being of a temporary and experimental nature; but they also expected to double their production without materially increasing the number of their permanent staff.

At this point, it is only due to bear testimony to the valuable assistance rendered by Mr. S. Mandrill, C.E., in designing the plans, conjointly with the Secretary, whose early training was that of an architect.

A healthy rivalry was kept up in the factory by naming certain styles of watches after the practical directors and foremen; thus, there was the A. Compensation watch, the J. Turner Pivot watch, &c., &c. Anyone introducing a practicable improvement received a royalty on the sale of watches to which it was applied, which, as far as the inventor was concerned, answered all the purposes of taking out a patent, without the expense and trouble of protecting it from infringement.

A well-arranged library, containing all the standard and current horological and scientific works in existence, was accessible to the employés; also, lectures were delivered at frequent intervals, open to the trade generally; but the Company did not think it incumbent upon them to provide a complete system of theoretical education, on account of the already existing organisations, which were being conducted at the public expense.

One of their main objects was to develop and encourage the personal abilities of everyone in their employment, so that if a man or youth engaged in a subordinate department felt that he was able to do better work, he was supplied with the means of doing so, in his own time. Anything in the shape of combinations among the workpeople, resulting in a "levelling system," was discouraged to the utmost. It was felt that this disposition among English workmen had been the means of driving trade away from the country in former years, and was especially objectionable in a manufacture which could not be sustained by machinery alone. This required ceaseless vigilance and attention on the part of the practical directors, who, having been themselves thoroughly trained on the old system, were able to appreciate its advantages; and it was only their active and personal co-operation which gave the factory a position above similar enterprises. Of this fact Jonathan was fully aware, and on his next, and for the time being, final visit, intimated that he felt no doubt as to the remunerative character of his investment, which he hoped to increase, both personally and through his friends, who could generally rely on receiving a good "lead" by imitating his example.

The directors were much gratified at the practical result of his visits and investigations, and feeling that the introduction of new blood into the concern was of the utmost importance, offered to place his name on the directorate, at the approaching annual meeting, in order that his valuable co-operation might be secured, not only in the States, but in the various countries visited by him in his travels. His answer, although perfectly courteous, was thoroughly characteristic:

"Guess I've gone far enough *this* journey. I never thought that any of *my* dollars would have been put in a concern that hadn't paid a dividend; but the fact of the matter is, you seem to *mean* business, and that's about the *hull* of it. Wish I had you over at the 'other side,' to show to our folks at home."

This compliment having been suitably acknowledged by the Chairman on behalf of his colleagues, the workpeople were summoned to the quadrangle, in order that a few kindly words might be addressed to them by their departing visitor.

He told them plainly that they were not wanted in America, the ordinary labour market there being quite overstocked; and their only chance was to rely on the long-established reputation of the English watch. They had the right sort of men to lead them, with plenty of cash and credit at their backs, and he saw nothing to prevent the factory developing into the biggest thing out. The Swiss and his own people had been cutting English watches out of foreign markets for years, and now it was only fair that the old country should re-assert itself. For his own part, it was only *business* with him. He believed in the almighty dollar being turned over, *whenever* and *wherever* there was a chance; and if he heard of a likely enterprise in China or Fiji, it was all one to him. He certainly, however, expected a great deal from Englishmen and Englishwomen, and had no doubt but they would, one and all, do their duty.

This speech was received with enthusiastic cheering, mingled with the strains of "The Star-spangled Banner," played by the amateur brass band, amid which he was driven off to his hotel, there to complete his arrangements for leaving this country.

Should he ever re-visit the National Watch Factory, the readers of this Journal shall be duly informed of the result of his observations; but for the present, Zadkiel's task is concluded, and he trusts that the time and trouble spent in preparing this and previous articles will not altogether have been thrown away.

The various characters he has introduced, from John Mainspring, Esq., downwards, are all indispensable to the establishment and working of a similar undertaking. It also seems certain that unless something is done soon, the opportunity will finally pass away. Nothing is wanted but organisation, and communications on the subject, addressed to the Editor of this Journal, will receive careful consideration.

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Queries and Replies.

Would you favour me, through your Journal, with the receipt to make the mercury amalgamating salt for Batteries, and you will oblige one, and perhaps many, of your numerous readers.—Applicant.

Can any reader oblige by informing me how to colour 9-carat gold and common articles of jewellery without the aid of a battery.—E. W.

Will any reader oblige by informing me the simplest and best means of preparing articles to be resilvered, so that the silver will adhere properly. I simply scratch-brush the articles, as the various dipping acids are not convenient to prepare or use.—Constant Reader.

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 29.)

"The liberal deviseth liberal things, and by liberal things shall he stand."

WE must now pass from considering the defects in key and keyless going barrel watches, which require improved construction, and proceed to enquire into the process of manufacture. But before I leave the subject that has occupied our attention for some months, I am very anxious to say a word or two as to its importance, and then, as far as I am able, offer such suggestions as I think will tend to further this important but of late sadly neglected branch of our art.

In this essay I have placed the word construction before the word manufacture, for this reason: the construction of a watch or any machine is a matter of far more importance than slight differences in the process of its manufacture. At the present time our attention seems so much engrossed in contentions about watchmaking by machinery, &c., that I fear, unless special efforts are made, we are in danger of overlooking this most profitable department of our business.

In times past construction was the favourite battle-field on which English horologists were always able to keep their continental rivals at bay; and in neglecting to adapt our watch to the requirements of our age we have, as a natural consequence, become an enfeebled people.

A law of nature does not cost as much as the red tape that ties up the worst act that Parliament ever passed, for it costs us nothing, it is a free gift; and the introduction of a new combination that embodies a sound and safe acting mechanism would do more to revive English watchmaking than the largest machine factory that our imagination can depict. For example: suppose I was in a position to state that the resilient escapement is at last an accomplished fact, that the labours of some of the leading horologists of the last fifty years have been crowned with success, that the banking error is a thing of the past; the following would be among the beneficial results:—

1st. No high-class adjusted watch would be made without the resilient action.

2nd. The entire movement might be revised to advantage. The speed of the balance would be diminished, and the weight of the balance increased, and much of the power now wasted in friction could be utilised for better purposes; the strength, durability, and good timekeeping qualities of the watch would be increased; many of the weak points in the keyless mechanism would be reduced to a minimum. An eight-day watch would be possible. All this, and for aught I know, much more, would be the beneficial result of a resilient lever escapement. Providing it could be made cheap and durable, the resilient escapement would be as far in advance of the present lever escapement as the existing lever escapement is superior to the horizontal escapement; and it would not matter a straw how cheaply or how well the present lever was made, it would give way to one that had the resilient action. And nothing that will so effectually hold the machine tool system of manufacture in check, and prevent it assuming undue proportions, as continually introducing such innovations as will commend themselves to the judgment of intelligent watchmakers. Speaking generally, it costs no more to make a soundly-constructed mechanism than it does to make one that is unsound. In some instances this statement will be wanting critical exactness, but in the main it is correct.

If, in this country, any new watchmaking enterprise is to be successful, we shall have to make a low-priced going barrel watch as far superior to the low-priced work of Switzerland and America as the low-priced work of these countries is undoubtedly superior to the cheap work we are making at the present time; and while much may be gained by improving our system of manufacture, much more may be gained by attending to the development of those things which tend to make our watch a sound and useful servant. I am very far from thinking that English watchmaking is in as flourishing a condition as it should be; yet I hold the world has been greatly benefited by the labours of English horologists, and it will be the best for all parts that we retain our identity; and in order to do this, let us at once discard the notion of making a cheap watch on the American or Swiss lines; no, we will construct a line of our own that shall be superior to both. English watchmaking is languishing to-day for the want of a new idea, that will impart to it the vigour, and freshness, and bloom of youth,—fit companions for its well-earned prestige and ripened years.

It is a very general opinion among men who are competent to judge in these matters, that a very large proportion of the errors in high-class timekeepers that arise from bad work are now comparatively of rare occurrence. So great has the progress in good workmanship been, that the errors arising from bad workmanship may be said to be entirely eliminated, and that for increased perfection we must look to improvement in construction.* And so great is the advantage of good workmanship, that without it no watch can be truly said to be cheap; and so numerous are the improved appliances for good work, that we may safely predict for low-priced watches the high standard realised in high-class timekeepers. But we cannot hope for such attainments in construction, because one degree of perfection is no sooner attained than it becomes the stepping-stone for another. "The best method of doing almost anything you can mention in mechanics has not yet been found out." And if we foster real improvements, twenty years hence the low-priced watches we now have will be laughed at.

I will now endeavour to offer some suggestion that will help us in improvements in construction.

First—I hold that we must not appeal to men of ability to devise improvements and endeavour to enlist their generous enthusiasm in this work, and immediately surround them by illiberal measures; for, in so doing, we permanently and hopelessly involve those who are working for our benefit. On the contrary, we must embody the spirit of the Mosaic law which stipulates, "Thou shalt not muzzle the ox when he treadeth out the corn."

It should not be necessary to make this demand, but it must be made with all earnestness, because the history of the going barrel watch in this country has been little short of unreasonable and unfair treatment; in some instances, scarcely showing common prudence, not to speak of common fairness.

I will give you an example: in the year 1879, the British Horological Institute offered the medal of the Turners' Company for the best made going barrel,—the only instance of encouragement in this country for going barrel work. Now, let us see how matters were conducted. Several competitors sent in specimens of work; one of them, a splendid piece of work, was sent by one of the best workmen in the country, but it was not considered worthy the medal, because it did not present any new features of improved construction. I also sent a specimen of work, in which improved construction was the chief feature, and in order to show the advantages claimed I sent a complete going barrel watch, one that had been made to the order of Mr. Samuel Jackson, a gentleman who has ever been the generous patron of improvements in going barrel work; and, to my astonishment, it was never examined beyond opening the case, but was, without examination, condemned as an obsolete failure. This I learned from the secretary of the Institute and three members of the council who were present at the meeting of examiners. Not satisfied with this proceeding, I wrote to the council (not for one moment contending that my specimens merited the medal at their disposal; I certainly thought, in fairness, they ought to be examined), earnestly requesting them to examine the watch I had sent. To this I received no reply. I wrote again, and recived an evasive answer, to the effect that I might examine the minutes of the meeting referred to. Finding in these minutes, Mr. Glasgow had been one of the prime movers in this matter, I deemed it my duty to call upon him, and, after some cross-questions, he admitted the axamination to have been such as I have described, and I told him, under such circumstances, it was not possible to command success, even if it were deserved. To this he replied: "The great thing was to get the medal without deserving it." Not thinking it advisable to prosecute inquiries further in this direction, as the hope of obtaining anything like justice was out of the question, I laid the whole matter before the President of the Institute, Sir Edmund Beckett, and he assured me that he had no power to influence the council, that they would not accept his advice in the matter, and he certainly did not consider that the opening of the case of a watch constituted a fair examination; yet the council have published in their journal for January, 1879, "that everything sent in in competition was examined at a very full meeting of the council, specially called for that purpose."

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* See Astronomer Royal's Report, 1880.

It is unnecessary, but I will do no less than add, that I hope there has not, at any time, a word escaped from my lips or pen that will lead you to suppose that I entertain an ungenerous thought of this Institution, or any of its members; on the contrary, there is no one more willing to pass by the offence than he who records it. But at the same time, I must express my conviction, that under such administration, the medal of the Turners' Company will do little good for English watchmaking, though, under more favourable circumstances, it would prove a valuable incentive to exertion.

Instead of treatment so manifestly unfair, which by the way would not be experienced in a going fusee competition, or any of our pet notions, we must show a willingness to encourage improvements, and be prepared to deal liberally with those who are successful in introducing them; and while I am far from thinking that the receipt of a medal, or even a prize of fifty pounds, is to be regarded as an equivalent for a valuable improvement, yet they have often been an important stimulus to exertion; and the giving of such should be of a tentative character, and not a permanent institution. The best way of rewarding those who labour in this direction, is to enable them to participate in the profits of the enterprise their improvements may create.

One of the most serious drawbacks in our patent laws is, that no protection is given to an inventor when the discovery he has made has become known to others. The result is, he must hug his ideas until they become an intolerable burden, and likely enough will make him a miserable misanthrope. We have lately read much about oppressive land laws and injustice to Ireland, but is there anything in that afflicted and unhappy country, by which, the property of landlord or tenant would be endangered, because the secret of its existence had become known to others? Mr. Gladstone recently told the House of Commons that no notice was taken of Irish grievances until the walls of Clerkenwell prison were blown down, and some of the worst passions developed; then we make conciliatory laws. In like manner, we shall not alter our patent laws until serious inroads have been made in our industries.

We must not forget that many great and most valuable improvements in this department of industry have been made by men of small intellectual calibre, and the most slender means. Not unfrequently has the diligent use of the one talent eclipsed the results of those who possess ten talents. It was not the brilliant genius of a Newton that devised the marine chronometer. He only asked for such an instrument as scores of others had done before him. It is to such men as John Harrison and Thomas Earnshaw that we are indebted for it. The former was a carpenter, many years resident in an obscure village in Lincolnshire, whose literary ability, I guess, was not great, for when he published a description of his chronometer, few were able to understand it. The latter tells us he was a watch finisher, having delicate health, irritable temperament, and received a poor education. But both were men of indomitable energy.

Richard Whittaker.

(To be Continued.)

A Jewellery Manufactory in Hull.

With the view of meeting the demands of business, and with combining the manufacture and sale of every description of work in gold and silver, Mr. B. Barnett has utilised his extensive property at the rear of his premises in Whitefriargate, and built a manufactory. The height and depth of the shop have been greatly increased, and the whole of the frontage will shortly be rebuilt, so as to make the building as elegant and imposing as the shop will be attractive. We may observe that Mr. Barnett intends to add to his present business that of a dealer in antique works of art, china, and articles of *vertu*, so that the shop, or rather the rear portion of it, will present all the characteristics of an art exhibition, Ranged along the sides of the added portion of the shop will be splendid cases, mirrors, timepieces, exquisite antique cabinets, and pictures. Especial care has been exercised to secure perfect ventilation and lighting. On the ground floor is a spacious warehouse and packing room, whilst on the first floor are large workrooms devoted to burnishing and polishing plate and jewellery. On the second floor are rooms for watch and chronometer makers, and for the execution of general repairs. On the third floor there is a long range of shops devoted to the manufacture of almost every kind of gold and silver jewellery, plating, gilding, frosting, colouring, &c., and special laboratories for rolling, melting, and testing metals. The lathes will be worked by a gas-engine. On the fourth floor, and rising above the general height of the main block of the building, is an observatory filled with transit instruments for taking true observations. The whole building is fitted up with special telephonic and electric communication, and the arrangements are as complete as experience and judgment can suggest. It will thus be seen that the improvement in the premises is of the most extensive character, whilst the introduction of the manufacture of plate and jewellery not only brings a new source of industry to Hull, but secures to purchasers the advantage of being able to have any design carried out on the spot. Few, if any, establishments in the provinces, not excepting Liverpool and Manchester, are more complete than Mr. Barnett's. The alterations and enlargement have been carried out by Mr. B. S. Jacobs, Architect.—*Communicated by* Mr. H. Bush.

Report of Screw Gauge Committee of the British Association.*

1. This committee was formed by the General Committee of the British Association assembled at York in August and September, 1881, for the purpose of determining a gauge for the manufacture of the various small screws in telegraphic and electrical apparatus in clockwork, and for other analogous purposes.

2. At that meeting a paper was read by Mr. Preece, pointing out the desirability of establishing such a gauge. Although the Whitworth gauge is almost invariably adopted for the bolts and screws used in millwork and engineering in England, no general system has been hitherto applied to the smaller screws used either in clockwork, philosophical instrument work, or in the numerous practical applications of electricity that are now rapidly becoming so important. In fact, at the present time, gauges and screw-plates almost equal in number the makers engaged in the trade. One instance was brought to the attention of the committee by a manufacturer who had to execute an order for railway signal apparatus, in accordance with three sample instruments, containing among them twenty-one screws of different threads, not one of which happened to be in use in his shop. There is now no recognised form of thread, no specified number of threads per inch—in fact, no generally accepted gauge, based on practice and experience. Great inconvenience is felt in providing for repairs, which are, in consequence, more costly and less efficient.

The employment of some coherent and uniform system is manifestly required. It not only would render repairs easier, speedier, and cheaper, but it would introduce interchangeability of parts, and further the extension of piece-work: and it would reduce the equipment of workshops with special and costly tools.

3. The subject of uniformity in screws has been very warmly taken up by the Société des Arts de Genève, which appointed a committee in December, 1876, who, after assiduous labours, issued a report in 1878. The system proposed by them has been fully described by Professor Thury in two pamphlets published in Geneva.† The committee collected numerous screws of all sizes from many factories, measured them carefully, tabulated their several dimensions, and plotted the results by the ordinary method of linear co-ordinates. They determined the mathematical equations to curves that most closely corresponded with the ratios of diameter to pitch thus found to have been employed in practice, and adopted the one which most nearly represented the mean average proportions of the screws in use at various shops, and in different countries.

The Swiss committee took 1 millimetre pitch as the basis of their system. It was agreed that such a pitch was best adapted to a screw having a diameter of 6 millimetres. The form of thread adopted was triangular, the angle made by producing the two sides being approximately $47\frac{1}{2}°$; the depth being $\frac{3}{5}$ of the pitch, the top being rounded off by a radius $\frac{1}{6}$, and the bottom by a radius $\frac{1}{5}$ of the pitch.

The committee has had an opportunity of examining screw-plates, and numerous packets of the corresponding screws manufactured on this system.

The following table gives the pitches and diameters in millimetres and "mils,"* to two significant figures, and the number of threads per inch of all the screws comprised in the small screw series, which happens to cover the exact ground to which the attention of the committee has been specially directed, namely, diameters below the $\frac{1}{4}$-inch.

TABLE OF SWISS SCREWS.

No.	Pitch.		Diameter.		Threads per inch.
	Mm.	Mil.	Mm.	Mil.	
25	0·072	2·8	0·25	10	357
24	0·080	3·1	0·29	11	323
23	0·089	3·5	0·33	13	286
22	0·098	3·9	0·37	15	250
21	0·11	4·3	0·42	17	233
20	0·12	4·8	0·48	19	208
19	0·14	5·3	0·54	21	189
18	0·15	5·9	0·62	24	170
17	0·17	6·6	0·70	28	152
16	0·19	7·3	0·79	31	137
15	0·21	8·1	0·90	35	124
14	0·23	9·0	1·00	40	111
13	0·25	10·0	1·2	46	100
12	0·28	11·	1·3	52	91
11	0·31	12·	1·5	59	83
10	0·35	14·	1·7	67	71·4
9	0·39	15·	1·9	76	66·7
8	0·43	17·	2·2	86	58·8
7	0·48	19·	2·5	97	52·6
6	0·53	21·	2·8	111	47·6
5	0·59	23·	3·2	126	43·5
4	0·66	26·	3·6	142	38·5
3	0·73	29·	4·1	162	34·5
2	0·81	32·	4·7	183	31·2
1	0·90	35·	5·4	208	28·6
0	1·00	39·	6·0	236	25·6

It is to be observed that the numbers by which the screws are designated, given in the first column, are not arbitrary. Each pitch of the series is $\frac{9}{10}$ths of that which succeeds it in the table.

Thus the several pitches are:—

$$1\text{ m.};\ \tfrac{9}{10}\text{mm.};\ \tfrac{9}{10})^2\text{mm.};\ \tfrac{9}{10})^3\text{mm.};\ ..\tfrac{9}{10})^n\text{mm.}$$

This series may be expressed in the form:—

$$0{\cdot}9^0;\ 0{\cdot}9^1;\ 0.9^2;\ 0{\cdot}9^3;\ \ldots\ 0{\cdot}9^n;\ \ldots \quad (1)$$

whence it is at once evident that the designating number of the screw is the index of the power to which 0·9 must be raised in order to ascertain its exact pitch in millimetres.

The method by which the relation between pitch and diameter is arrived at will be gathered from the following explanation:—

Let D represent the diameter and P the pitch. Then, generally,

$$D = f(P)$$

Evidently there can be no constant term, for when D = O, P must also = O. Moreover, D practically cannot be a simple multiple of P, for experience has shown that small screws must have a less number of threads per diameter than large screws.

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* Report of the Committee, consisting of Sir Joseph Whitworth, Dr. Siemens, Sir F. J. Bramwell, Mr. A. Strob, Mr. Beck, Mr. W. H. Preece, Mr. E. Crompton, Mr. E. Rigg, Mr. A. Le Neve Foster, Mr. Latimer Clark, Mr. Buckney, and Mr. H. Trueman Wood (Secretary), appointed for the purpose of determining a gauge for the manufacture of the various small screws used in Telegraphic and Electrical Apparatus in Clockwork, and for other analagous purposes.

† "Systématique des vis Horlogères, Genève," 1878. "Notice sur le Système des vis de la Filière Suisse." Genève, 1880.

* The "mil" is the thousandth part of the British inch.

Hence the formula will be of the form

$$D = m\,P^{k} \quad . \quad . \quad . \quad (2)$$

where m and k are constants to be determined.

Since 1^{k} is 1 whatever be the value of k, it follows that the co-efficient m represents the value of D when P is 1. The Swiss committee agreed that the unit pitch (1 millimetre) should be adopted for the screw having a diameter of 6 millimetres; in other words they make $m = 6$.

The value of k must be ascertained by trial.

$k = 1$ would give a constant ratio, which we know is inadmissible.

$k = 2$ will be found on trial to give a far too rapid decrease in the ratio of diameter to pitch.

The several simple fractions between these limiting values were tried in succession, and the results obtained when using $\frac{6}{5}$ were found to give results that best accord with practice and experience.

Substituting the values thus arrived at in (2), the formula becomes

$$D = 6P^{\frac{6}{5}} \quad . \quad . \quad . \quad (3)$$

The Swiss system is thus very complete, but there are reasons which prevent this committee from recommending its adoption in its entirety.

4. No one has done more to establish gauges of all kinds in England than Joseph Whitworth. His classical paper on "A Uniform System of Screw Threads," was communicated, as far back as 1841, to the Institution of Civil Engineers. He had made an extensive collection of screw-bolts from the principal workshops throughout England, and the average thread was carefully measured for different diameters. The $\frac{1}{4}$, $\frac{1}{2}$, 1, and $1\frac{1}{2}$ inches were selected and taken as the fixed points of a scale by which the intermediate sizes were regulated. The result is an admirable thread for the large iron bolts and screws used in fitting up steam-engines and other machinery. The angle made by the sides of this thread is 55°. One-sixth of the depth of the thread is rounded off from the top, and one-sixth from the bottom. The actual depth is rather more than three-fifths, and less than two-thirds of the pitch.

The slow adoption of such an admirable system was perhaps due, in great measure, to the fact that it was put forward by an individual, and not by an association. A single individual, however exalted his reputation, cannot secure that immediate and universal attention which is obtained by such an organisation as the British Association. The system of units of electrical measurements sanctioned by the association obtained instant recognition, and has now, thanks to the Congress of Electricians, held in Paris in October, 1881, become universally accepted. It is hoped that the same result will follow the recommendations of this committee.

5. The question of the introduction of the metrical system occupied the serious consideration of the committee, but, considering the fact that it is not generally adopted in engineering or manufacture in England, and that it as yet little understood by our workmen, it was thought better to suggest no change in this direction. The committee is not insensible to the simplicity of the metrical system and to its possible universality, nor to the fact of its gradual introduction in scientific circles; but while the manufacturing interests are still wedded to the British inch, and its multiples and its sub-multiples, and while the British legal standard of length is still the yard, the committee has felt it impossible to suggest a change which has little chance of adoption, and which may jeopardise the introduction of that with which they are more concerned—viz., a uniform screw-thread.

Hence it was determined that the unit of length taken should be the "mil," and that the decimal system should be adopted for expressing dimensions.

6. The use of a screw is to draw together and to unite certain parts of apparatus in firm and intimate contact. To attain these ends, a screw must facilitate the application of mechanical power to draw the parts together, and it must possess strength to hold them so; it must not interfere with the easy separation of these united parts when necessary; it must possess durability—that is, it must be capable of repeated use without undue friction and without wear, otherwise it will speedily become loose, and dangerous when frequently removed and restored There has to be considered the pitch of the screw, its relation to the diameter of the bolt on which it is cut, the depth of the cut, and the form of the thread. The pitch primarily determines the power of the screw, for it determines, for each diameter, the angle of the inclined plane; the depth determines the section of core left to resist shear or rupture; while the form of the thread determines the durability and efficiency, and determines also the surface of thread to bear endway strain.

7. The committee have devoted very considerable attention to the pitch, form, and depth of screws, and they have compared together a large number of different kinds, some of which are in actual use, while others have only been suggested. They have, moreover, decided on recommending the adoption of the Whitworth form of thread, not only because it is so well known, but because experience has proved it excellent and unsurpassed when employed for engineers' bolts. The committee, however, are not unanimous on all questions involved by this proposal, and as there are several points that require to be thoroughly sifted and tested, they ask to be reconstituted, and to be allowed a small grant to put their proposal to the test of practice, and to have a few gauges constructed for distribution or examination.

HYDROFLUORIC acid is recommended as a test for diamonds. It will not affect the diamond, while it quickly corrodes glass, which is the material of most of the imitation gems. The only objection to its use is that it will attack certain stones of minor but real value, like the topaz, which are sometimes passed off as diamonds. Of course, being a dangerous agent to experiment with, it must be employed with great caution. The following directions from the *Manufacturer and Builder* may be safely followed—Take a leaden vessel, of saucer shape and moderate size, in which place some powdered fluorspar, which cover with enough oil of vitriol to completely moisten the powder. Then put in the stone to be tested, and gently warm the mixture over a gas lamp or any other convenient source of heat. This should be done in a good draft, where the vapours will be drawn up a chimney or dissipated, as they are dangerous to breathe. When the evolution of vapours appear to have ceased, which will occur in from five minutes to a quarter of an hour, according to the quantity of material employed, the heat should be withdrawn and the vessel allowed to cool. The stone may now be fished out from the pasty mass and examined. If it shows no signs of being attacked, you may be assured that it is a genuine stone. A paste stone will be found to be strongly corroded by the hydrofluoric acid that has come in contact with it; and if a small one, it will probably have been entirely dissolved.

John Harrison, the Chronometer Maker.

(Continued from page 78.)

THE remarkable success which Harrison had achieved in his compensating pendulum could not but urge him on to further experiments. He was no doubt to a certain extent influenced by the reward of £20,000 which the English Government had offered many years before for an instrument that should enable the longitude to be more accurately determined by navigators at sea than was then possible; and it was with the object of obtaining pecuniary assistance to assist him in completing his chronometer that Harrison made his first visit to London to exhibit his drawings in 1728.

The Act of Parliament offering this superb reward was passed in 1714, in the twelfth year of the reign of Queen Anne. It was right that England, then rapidly advancing to the first position as a commercial nation, should make every effort to render navigation less hazardous. At that time the ship, when fairly at sea, out of sight of land, and battling with the winds and tides, was in a measure lost. No method existed for accurately ascertaining the longitude. The ship might be out of its course for one or two hundred miles, for anything that the navigator knew; and only the wreck of his ship on some unknown coast told of the mistake which he had made in his reckoning.

It may here be mentioned that it was comparatively easy to determine the latitude of a ship at sea every day when the sun was visible. The latitude—that is, the distance of any spot from the equator and the pole—might be found by a simple observation with the sextant. The altitude of the sun at noon is found, and by a short calculation the position of the ship may be ascertained.

The sextant, which is the instrument universally used at sea, was gradually evolved from similar instruments used from earliest times. The object of these instruments has always been to find the angular distance between two bodies—that is to say, the angle of two straight lines which are drawn from those bodies to meet in the observer's eye. The simplest instrument of this kind may be well represented by a pair of compasses. If the hinge is held to the eye, one leg pointed to the distant horizon, and the other leg pointed to the sun, the two legs will be separated by a certain angle, which will be the angular distance of the sun from the horizon at the moment of observation.

Until the end of the seventeenth century the instrument used was of this simple kind. It was generally a large quadrant, with one or two bars moving on a hinge,—to all intents and purposes a huge pair of compasses. The direction of the sight was fixed by the use of a slit and a pointer, much as in the ordinary rifle. This instrument was vastly improved by the use of a telescope, which not only allowed fainter object to be seen, but especially enabled the sight to be accurately directed to the object observed.

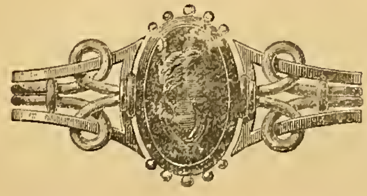
The instruments of the pre-telescopic age reached their glory in the hands of Tycho Brahe. He used magnificient instruments of the simple "pair of compasses" kind—circles, quadrants, and sextants. These were for the most part ponderous fixed instruments, and of little or no use for the purposes of navigation. But Tycho Brahe's sextant proved the forerunner of the modern instrument. The general structure is the same; but the vast improvement of the modern sextant is due, firstly, to the use of the reflecting mirror, and, secondly, to the use of the telescope for accurate sighting. These improvements were due to many scientific men—to William Gascoigne, who first used the telescope, about 1640; to Robert Hooke, who, in 1660, proposed to apply it to the quadrant; to Sir Isaac Newton, who designed a reflecting quadrant;[*] and to John Hadley, who introduced it. The modern sextant is merely a modification of Newton's or Hadley's quadrant, and its present construction seems to be perfect.

It therefore became possible accurately to determine the position of a ship at sea as regarded its latitude. But it was quite different as regarded the longitude—that is, the distance of any place from a given meridian, eastward or westward. In the case of longitude there is no fixed spot to which reference can be made. The rotation of the earth makes the existence of such a spot impossible. The question of longitude is purely a question of TIME. The circuit of the globe, east and west, is simply represented by twenty-four hours. Each place has its own time. It is very easy to determine the local time at any spot by observations made at that spot. But, as time is always changing, the knowledge of the local time gives no idea of the position of a moving object—say, of a ship at sea. But if, in any locality, we know the local time, and also the local time of some other locality at that moment—say, of the Observatory at Greenwich—we can, by comparing the two local times, determine the difference of local times, or, what is the same thing, the difference of longitude between the two places. It was necessary, therefore, for the navigator to be in possession of a first-rate watch or chronometer, to enable him to determine accurately the position of his ship at sea, as respected the longitude.

Before the middle of the eighteenth century, good watches were comparatively unknown. The navigator mainly relied upon his Dead Reckoning, without any observation of the heavenly bodies. He depended upon the accuracy of the course which he had steered by the compass, and the mensuration of the ship's velocity by an instrument called the log, as well as by combining and rectifying all the allowances for drift, lee-way, and so on, according to the trim of the ship; but all of these were liable to much uncertainty, especially when the sea was in a boisterous condition. There was another and independent course which might have been adopted—that is, by observation of the moon, which is constantly moving amongst the stars from west to east. But until the middle of the eighteenth century good lunar tables were as much unknown as good watches.

Hence a method of ascertaining the longitude, with the same degree of accuracy which is attainable in respect of latitude, had for ages been the grand desideratum for men "who go down to the sea in ships." Mr. Macpherson, in his important work entitled "The Annals of Commerce," observes, "Since the year 1714, when Parliament offered a reward of £20,000 for the best method of ascertaining the longitude at sea, many schemes have been devised, but all to little or no purpose, as going generally upon wrong principles, till that Heaven-taught artist, Mr. John Harrison, arose;" and by him, as Mr. Macpherson goes on to say, the difficulty was conquered, having devoted to it "the assiduous studies of a long life."

(To be Continued.)



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[*] Sir Isaac Newton gave his design to Edmund Halley, then Astronomer Royal. Halley laid it on one side, and it was found among his papers after his death in 1742, and twenty-five years after the death of Newton.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(*Continued from page 74*.*)

COMPARED ASSAY-REPORTS ON SILVER BULLION-

Trade Report	dwts. fine. in the lb. Troy.	Equivalent of Fine Silver.	Copper.	Fine Contents. per oz.
Better 18 dwts. =	240	1·000	·000	20 dwts. —
,, 17 ,, =	239	·995	·005	19 ,, 22 grs.
,, 16 ,, =	238	·991	·009	19 ,, 20 ,,
,, 15 ,, =	237	·987	·013	19 ,, 18 ,,
,, 14 ,, =	236	·983	·017	19 ,, 16 ,,
,, 13 ,, =	235	·979	·021	19 ,, 14 ,,
,, 12 ,, =	234	·975	·025	19 ,, 12 ,,
,, 11 ,, =	233	·970	·030	19 ,, 10 ,,
,, 10 ,, =	232	·966	·034	19 ,, 8 ,,
,, 9 ,, =	231	·962	·038	19 ,, 6 ,,
,, 8 ,, =	230	·958	·042	19 ,, 4 ,,
,, 7 ,, =	229	·954	·046	19 ,, 2 ,,
,, 6 ,, =	228	·950	·050	19 ,, — ,,
,, 5 ,, =	227	·945	·055	18 ,, 22 ,,
,, 4 ,, =	226	·941	·059	18 ,, 20 ,,
,, 3 ,, =	225	·937	·063	18 ,, 18 ,,
,, 2 ,, =	224	·933	·067	18 ,, 16 ,,
,, 1 ,, =	223	·929	·071	18 ,, 14 ,,
,, ½ ,, =	222½	·927	·073	18 ,, 13 ,,
Standard =	222	·925	·075	18 ,, 12 ,,
Worse ½ dwt. =	221½	·923	·077	18 ,, 11 ,,
,, 1 ,, =	221	·920	·080	18 ,, 10 ,,
,, 2 ,, =	220	·916	·084	18 ,, 8 ,,
,, 3 ,, =	219	·912	·088	18 ,, 6 ,,
,, 4 ,, =	218	·908	·092	18 ,, 4 ,,
,, 5 ,, =	217	·904	·096	18 ,, 2 ,,
,, 6 ,, =	216	·900	·100	18 ,, — ,,
,, 7 ,, =	215	·895	·105	17 ,, 22 ,,
,, 8 ,, =	214	·891	·109	17 ,, 20 ,,
,, 9 ,, =	213	·887	·113	17 ,, 18 ,,
,, 10 ,, =	212	·883	·117	17 ,, 16 ,,
,, 11 ,, =	211	·879	·121	17 ,, 14 ,,
,, 12 ,, =	210	·875	·125	17 ,, 12 ,,
,, 13 ,, =	209	·870	·130	17 ,, 10 ,,
,, 14 ,, =	208	·866	·134	17 ,, 8 ,,
,, 15 ,, =	207	·862	·138	17 ,, 6 ,,
,, 16 ,, =	206	·858	·142	17 ,, 4 ,,
,, 17 ,, =	205	·854	·146	17 ,, 2 ,,
,, 18 ,, =	204	·850	·150	17 ,, — ,,
,, 19 ,, =	203	·845	·155	16 ,, 22 ,,
,, 1 oz. =	202	·841	·159	16 ,, 20 ,,
,, 2 ,, =	182	·758	·242	15 ,, 4 ,,
,, 3 ,, =	162	·675	·325	13 ,, 12 ,,
,, 4 ,, =	142	·591	·409	11 ,, 20 ,,
,, 5 ,, =	122	·508	·492	10 ,, 4 ,,
,, 6 ,, =	102	·425	·575	8 ,, 12 ,,
,, 7 ,, =	82	·341	·659	6 ,, 20 ,,
,, 8 ,, =	62	·258	·742	5 ,, 4 ,,
,, 9 ,, =	42	·175	·825	3 ,, 12 ,,
,, 10 ,, =	22	·091	·909	1 ,, 20 ,,
,, 10 ,, 1 dwt =	21	·087	·913	1 ,, 18 ,,
,, 10 ,, 2 ,, =	20	·083	·917	1 ,, 16 ,,
,, 10 ,, 3 ,, =	19	·079	·921	1 ,, 14 ,,
,, 10 ,, 4 ,, =	18	·075	·925	1 ,, 12 ,,
,, 10 ,, 5 ,, =	17	·070	·930	1 ,, 10 ,,
,, 10 ,, 6 ,, =	16	·066	·934	1 ,, 8 ,,
,, 10 ,, 7 ,, =	15	·062	·938	1 ,, 6 ,,
,, 10 ,, 8 ,, =	14	·058	·942	1 ,, 4 ,,
,, 10 ,, 9 ,, =	13	·054	·946	1 ,, 2 ,,
,, 10 ,, 10 ,, =	12	·050	·950	1 ,, — ,,
,, 10 ,, 11 ,, =	11	·045	·955	— 22 ,,
,, 10 ,, 12 ,, =	10	·041	·959	— 20 ,,
,, 10 ,, 13 ,, =	9	·037	·963	— 18 ,,
,, 10 ,, 14 ,, =	8	·033	·967	— 16 ,,
,, 10 ,, 15 ,, =	7	·029	·971	— 14 ,,
,, 10 ,, 16 ,, =	6	·025	·975	— 12 ,,
,, 10 ,, 17 ,, =	5	·020	·980	— 10 ,,
,, 10 ,, 18 ,, =	4	·016	·984	— 8 ,,
,, 10 ,, 19 ,, =	3	·012	·988	— 6 ,,
,, 11 ,, — ,, =	2	·008	·992	— 4 ,,
,, 11 ,, 1 ,, =	1	·004	·996	— 2 ,,
,, 11 ,, 1½ ,, =	½	·002	·998	— 1 ,,

Milliemes converted into dwts. and grains fine of Silver Assay-Reports.

Milliemes.		Fine Contents. In the pound troy. dwts.	grs.	Per ounce. dwts.	grs.
1·000	=	240	—	20	—
·900	=	216	—	18	—
·800	=	192	—	16	—
·700	=	168	—	14	—
·600	=	144	—	12	—
·500	=	120	—	10	—
·400	=	96	—	8	—
·300	=	72	—	6	—
·200	=	48	—	4	—
·100	=	24	—	2	—
·090	=	21	14½	1	19¼
·080	=	19	4¾	1	14½
·070	=	16	19¼	1	9½
·060	=	14	9½	1	4¾
·050	=	12	0	1	0¼
·040	=	9	14½	—	19½
·030	=	7	4¾	—	14½
·020	=	4	19¼	—	9¾
·010	=	2	9½	—	4¾
·009	=	2	3¾	—	4¼
·008	=	1	22	—	3¾
·007	=	1	16¼	—	3¼
·006	=	1	10½	—	3
·005	=	1	4¾	—	2½
·004	=	—	23	—	2
·003	=	—	17¼	—	1½
·002	=	—	11½	—	1
·001	=	—	5¾	—	0½

Value of Fine Silver calculated to Milliemes of an ounce.

		s.	d.			s.	d.
Per 1 ounce	..	5	0	Per ·050 ounce	..	0	3
,, ·900 ,,	..	4	6	,, ·040 ,,	..	0	2½
,, ·800 ,,	..	4	0	,, ·030 ,,	.	0	1¾
,, ·700 ,,	..	3	6	,, ·020 ,,	..	0	1¼
,, ·600 ,,	..	3	0	,, ·010 ,,	..	0	0½
,, 500 ,,	..	2	6	,, ·009 ,,	..	0	0½
,, ·400 ,,	..	2	0	,, ·008 ,,	..	0	0⅜
,, ·300 ,,	..	1	6	,, ·007 ,,	..	0	0⅜
,, ·200 ,,	..	1	0	,, ·006 ,,	..	0	0⅜
,, ·100 ,,	..	0	6	,, ·005 ,,	..	0	0¼
,, ·090 ,,	..	0	5½	,, ·004 ,,	..	0	0¼
,, ·080 ,,	..	0	4¾	,, ·003 ,,	..	0	0¼
,, ·070 ,,	..	0	4¼	,, ·002 ,,	..	0	0⅛
,, ·060 ,,	..	0	3½	,, ·001 ,,	..	0	0¹/₁₆

For Alloying Standard by mixing superior and inferior qualities reported in Milliemes, the same rules as given on page 60 (No. 90), are applicable for finding the respective proportions, viz.:

·945 fine ·893 ,,	·925	32 parts of ·945 fine. 20 ,, ·893 ,,

In order to find the proportions of an inferior quality of Silver to be added to a *given* quantity of a superior quality, to compose Standard, multiply the given quantity by the Milliemes superior to Standard, and divide the product by the Milliemes inferior to Standard of the Silver to be added to compose Standard. What proportion of Silver ·875 fine will have to be added to 35 ozs. of Silver ·940 fine, in order to compose Standard of ·925 fine?

35 ozs ·940 fine.
Multiply by superiority of 15 to Standard of ·925.

Divide by inferiority of 50)525(10 ozs. 10 dwts. of Silver ·875 fine.
of Silver ·875 fine
to Standard of ·925
add 35 ,, — ,, of ,, ·940 ,,
making 45 ozs. 10 dwts. of Stand. ·925 fine.

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* ERRATA.—The grains and quarters attached to the line of 21 carats, in the second column of page 74 In last month's issue, should begin with ¼-gr. on the top, and increase by quarters up to 3¾ grs. and finish with 3⅞ grs. at the bottom instead of *vice versa*, in order to correct the equivalents of Carat fine and Milliemes.

A Mysterious Jewel Robbery.

MR. HENGIST SKIDMORE is the younger son of a junior offshoot of an ancient family. The blood that flows in his veins is heraldically very blue, but his fortune when he came of age was exceedingly limited, and was soon spent. A Skidmore cannot condescend to commerce, and therefore Hengist, by a contract of marriage bartered his ancient blood for new riches.

Heraldically Miss Maria Binns never had a grandfather. Her Pa, the late Mr. Thomas Binns, began his career as a miner, but being a clever and plucky man he left the coal pit and the country to seek a fortune. When he was abroad his hand seemed to have a Midas touch. He found gold in Australia, struck oil in America, smuggled opium into China, returned to his native land, worth full £8,000 a year, became a member of Parliament, was venerated as a distinguished philanthropist, lived on the fat of many lands, died in the odour of sanctity, and his daughter Maria inherited his property. The Skidmore blue blood and the Binns new riches met and married. Before being Binns no more the lady insisted upon a settlement, excluding her proposed twain flesh from any share in the control of the property; and the bridegroom-elect being pecuniarily not only off his last legs but also off his last crutch, assented to the hard conditions. Mrs. Skidmore allowed her husband £400 a year, paid quarterly for his personal expenditure, and affectionately congratulated him on her marvellous generosity.

Mr. Skidmore owed a few debts, and his habits were not strictly economical. Unfortunately for him the terms of the marriage settlement were not generally known, and consequently, as the consort of an eight-thousand-per-annum lady, he readily obtained credit from tradesmen, and loans from the accommodating gentlemen who never pay the least regard to the Bank of England *minimum*. Within two years from the auspicious day when he had leased himself for life to the prudent Maria, he was deeply in debt and dreadfully dunned. His courage being spurred by necessity, he ventured to ask his wife for a loan. Her reply proved that although she might love him much, she was still fonder of her property.

"Hengist, I am not a fool, and I would rather put on weeds to-morrow than give you a sixpence more than your liberal allowance."

Mr. Skidmore applied to his friend Captain Kiddell. The name of Arthur Kiddell is not in the Army List or in the Navy List, but he is supposed to have attained military rank in foreign service.

man. In chess he has invented a new gambit. He has, he says, played whist with Imperial Chancellors. Professional billiard players applaud his side stroke. He has, so he avers, won money on the turf. He asserts that he has an infallible system for winning money on the Stock Exchange

He would be delighted to help Mr. Skidmore. He was at that moment engineering a Stock-Exchange rig that must be a fortune to those who were lucky enough to "be in the swim." If Mr. Skidmore put in £4000 he would take £14,000 of the spoil in less than six weeks. But where, oh where, was the £4000? Captain Kiddell would have been charmed to lend the money, but he had already overdrawn his account to oblige a noble friend. The Captain claims to be a Napoleon in finance.

"My dear fellow, you say you have nothing, and so can get nothing, but *ex nihilo nihil fit*, is a maxim only fit for greenhorns You shall borrow the money."

Mr. Chapeau, who lends money on securities that are not negotiable in Lombard Street, agreed to give £4000 for a £6000 promissory note, at two months' date.

"Chapeau and his tribe have a tremendous swallow. But, my dear fellow, you will net £10,000 at least, and when you have paid the £2000, you will be £8000 in pocket."

Mr. Chapeau was somewhat fastidious, for a hundreds per cent. per annum lender. He insisted upon Mrs. Skidmore joining in the promissory note. Mr. Skidmore could not even ask her to do so. Captain Kiddell held that a husband had authority to sign his wife's name. Besides, Mrs. Skidmore would not hear of the affair. Chapeau would not part with the note, and it could be paid and burnt in six weeks, a full fortnight before it was due.

Mr. Skidmore had £500 for his immediate wants; Capt. Kiddell kindly advancing £500 to make up the £4000 for the infallible rig. Alas! even a Kiddell is not infallible, and for once the 'cute Captain was mistaken. The rig totally failed, and all the invested money was lost.

"My dear fellow," said the Captain, "I have dropt ten thousand, but I shall win on the double-double venture; for I never go in for mere double or quits. But your fix with the Chapeau note is confoundedly awkward. If your wife won't lend you the money, why not borrow her jewels? Being so cruelly cornered, it is your duty to help yourself."

"The jewels are in the settlement. Kiddell, I am utterly ruined. She will not part with a penny to save me from penal servitude."

"If she had done Arthur Kiddell the honour to take his name in wedlock, she would have been made to part. But, my boy, don't talk about being dry docked We must weather the storm."

"Chapeau won't wait, and the moment he applies to her, my prosecution will begin."

"The most cruel fix I ever heard of! Oh, the vanity and vexatiousness of woman! I suppose the jewels of your wife would pay Chapeau's bill twice over?"

"The jewels are worth over £20,000. But it is no use talking about her property. In a few weeks a Skidmore will be a convict."

"I will rescue you, my dear fellow. Let us dine, and while we wine discuss my stratagem."

When Mr. Skidmore reached home he was so pale that his wife thought he was ill, and said—

"Hengist, you must see the doctor, for if you have fever I shall at once leave you and go to Brighton. I have such a dread of fever."

Mr. Skidmore not being stricken with fever, Mrs. Skidmore was not obliged to quit London in the midst of the season. Twice a week she appeared at the opera decorated with nearly all her costly jewels. Among the constant visitors to the Skidmore box were Captain Kiddell and his friend Count Van de Hoeven.

Mrs. Skidmore went to Brighton for a fortnight because she did not feel quite so well as usual. Whenever she visited Brighton her principal jewels, including the diamond necklace, the diamond bracelets, and the superb diamond cluster that decorated her hair, were taken to the bank. She put the jewels into the jewel box and locked it. Her husband locked the jewel-box in an iron box, and attended his wife to deposit the treasure at the bank. No one could charge Mrs. Skidmore with the carelessness that encourages robbery. When she was in town the jewels were kept in an iron safe fixed in her bedroom, that was warranted fire-proof and thief-proof.

If an irresistible force encountered an immoveable mass, what would be the result? The answer to this school-boy catch problem is that there cannot be an irresistible force if there is an immoveable mass, and *vice versâ*. Final or supreme physical force is at present undiscovered. There is no absolute security for property against those who are resolved to break through and steal. That was the bitter experience of Mrs. Skidmore.

The sojourn at Brighton terminated on Friday afternoon.

On Saturday afternoon Mrs. Skidmore, attended by her husband, went to the bank and brought home the iron box that contained the jewel case. The lady unlocked the jewel case, glanced at her jewels, relocked the case, put it into the iron safe, and with her own fair hand locked the iron safe. Could fondest mother be more careful of her children than Mrs. Skidmore of her jewels?

Having been operated upon by her lady's-maid for a full hour, Mrs. Skidmore departed with her husband for Richmond, having been invited by Captain Kiddell to an early, that is, a five o'clock dinner.

"Now Hengist, be sure to leave instantly after the dinner, for I am determined to be at the opera to-night."

There was a mistake as to the dinner hour. The early repast was for six, not five o'clock. Captain Kiddell's party included Count Van de Hoeven, who proposed a promenade in the grounds.

Mrs. Skidmore was walking with the Count. The Captain took Mr. Skidmore aside.

"Let us light a cigar."

The Captain handed his case to Mr. Skidmore, and then took a cigar himself.

"Look at that little document before we light our cigars."

The document was the promissory note that had been given to Mr. Chapeau. The Captain ignited a wax match and burnt the promissory note.

"There is an end to the perilous bit of paper. Now my boy, let us have a peaceful smoke, whilst the Count amuses Mrs. Skidmore. As for your being in town in time for the opera, that is almost impossible. Punctuality is not one of the virtues of this pleasing place."

It was nearly seven o'clock before the dinner was served, and it was within an hour of midnight when Mrs. Skidmore arrived at her residence.

"I am vexed about the opera, but I am not sorry to go to bed. I am so drowsy that I cannot keep my eyes open. I suppose the Richmond air is of the sleepy sort."

Mrs. Skidmore had been dosing during the ride home, and she slept whilst being undressed by her maid. Next day she complained of headache, and remained in her room, but about six o'clock felt better and able to be dressed.

"I am glad that I can go down to dinner, for our guests would be dreadfully dull if I were not present. Norah, I may as well air my jewels to-night."

Mrs. Skidmore took a neat leather case from her pocket, and out of the case a key.

She could not get the key into the lock of the iron safe.

"There is something in the lock. Or else the key is at fault. Norah, ask the master to come to me."

When the maid returned with the master, Mrs. Skidmore was still at the iron safe.

"Is it not strange, Hengist, I cannot get the key into the lock? You try."

Mr. Skidmore was as unsuccessful as his wife.

"How provoking Hengist. I suppose one of the bolts has slipped, and we shall have to send for the locksmith."

So saying she put her hand on the handle, and behold the door opened.

"I swear I locked it when I went out yesterday. I must have unlocked it without knowing that I did so."

Mrs. Skidmore looked into the safe and screamed. Pulling out some papers, and the iron box used for conveying the jewels to the bank, she yelled with horror.

"My dear, what is the matter?"

"My jewels, my jewels, my jewels!"

Mr. Skidmore looked into the safe.

"My jewels! Fool, why don't you do something?"

"My dear, I am so upset that I don't know what to do."

"Go for the police. Go to Scotland Yard. Oh, what shall I do? Oh, my jewels!"

The rage and the terror of Mrs. Skidmore cannot be described. Her magnificent diamonds, worth at least £20,000 were gone. The detectives came and examined the safe, and minutely questioned all the servants. Presently they looked at the windows. There was a balcony to the side window, and to one of the girders of the balcony a rope was tied. That indicated the way in which the thief had got in and out of the room. How the thief-proof safe was opened could not be explained. The burglary must have been committed whilst Mrs. Skidmore was at Richmond.

A large reward was offered, and the investigation was directed by Mr. James Burrow, one of our cleverest detectives. After a fortnight there appeared to be a chance of a clue. The pendant to the necklace was a diamond of rather peculiar colour, of large size, and it had a slight flaw. Burrow ascertained that such a diamond was in the hands of a London dealer. The jeweller who had sold the necklace to Mrs. Skidmore identified the stone. Burrow tracked the movements of the stone and found that it had been sent to Holland by a person named Van de Hoeven. But the clue that seemed so promising completely failed. It was proved that the diamond had been in the hands of the dealer and had been offered by him to two leading firms three weeks before the robbery, and Mrs. Skidmore had seen her jewels the very day they were stolen.

"So much for the positive identification of a stone," said Burrow.

Six months passed, and there was no hope, whatever, of recovering the diamonds. Burrow called on Mrs. Skidmore.

"Any news now, Burrow?"

"The diamonds are clean gone, but I think I have found out how the job was done. Would you like to hear my view?"

Mr. Skidmore had been treated for a nervous disorder, and he was not yet well. His voice was rather tremulous when he replied:—

"Certainly, Mr. Burrow."

Mr. Skidmore turned his face from the detective, and appeared to be closely studying the pattern of the carpet.

"Being on another job, by a half chance I discovered that paste imitations of Mrs. Skidmore's jewels had been made by a Paris house, about two months before the robbery. Also the imitation jewels were put into a case, corresponding in colour and shape with Mrs. Skidmore's jewel case. What do you think of that, sir."

Mr. Skidmore had to clear his throat before he spoke, and still his voice was husky.

"What have paste jewels to do with the stealing of my wife's diamonds?"

"It is the true clue, Mr. Skidmore, just as the rope tied to the balcony was a false scent. The identification of the big stone was correct. The genuine diamonds were stolen weeks before the imitations were taken from the iron safe. You are pale, sir, and you are shaking as if you had ague."

"I am not well. I suffer from nervous attacks."

"I could run in the accomplices. Say, a bill discounter who dusts forged bills, a notorious blackleg gamester, and a foreign party who deals in stolen jewels. But what is the use of running in the accomplices if you mustn't touch the principal?—especially as not a sixpence of the property can be recovered. I have my eye on the principal, and can show you his photo. There it is, look at it."

With a trembling hand, Mr. Skidmore took the mounted photograph from Burrow. He looked at it, groaned, gasped for breath, and dropt it.

"Dear me, Mr. Skidmore, I have not given you a photo, but a hand mirror. It is your own face that has scared you."

Mr. Burrow put the hand mirror into his pocket.

"It is a queer game, but not new or uncommon. No wonder the detectives are often baffled over these jobs. Good day to you, sir. I think you will now agree with me that to me, as well as to you, the Skidmore jewel robbery is not a mystery."—*Life.*

Hall-marking.*

By G. E. Gee.

(Continued from page 73).

BESIDES the drawbacks mentioned in our last number, which cannot but be injurious to our trade, there is another exception which we take to the system of hall-marking in this country; and that is the manner of testing, as well as the way in which the marking is done, and which gives rise to much annoyance to manufacturers. The system now in vogue of scraping and cutting the work is very unsatisfactory, practically speaking; inasmuch as it not only necessitates part of it being done over again, but to some extent destroys the true form and symmetry of the parts which are left, more especially when more than one assay has to be effected in ascertaining the correct fineness of the material under trial. In the case of a locket, the various parts are all required to be tested and marked, and to do this it is necessary to cut out a portion of the material of one part to supply the substance to work upon; the other pieces may be scraped to provide the other portion, and the parts that have been scraped may be finished when the stamps have been struck upon them; but that which has been cut is rendered perfectly useless, and a new part has to be made in its place before the locket can be finished ready for sale. This causes no little annoyance, not only to the master, but also the workmen who originally made the article. Besides, what proof have the public that these additions to hall-marked wares, so cut and defaced, are of the same fineness as the originally prepared parts which were destroyed in the process of hall-marking.

These remarks apply not only to lockets, but to all wares which are cut and disfigured in the process of striking the hall-marks; but in justice to the authorities at the halls, we must state that the system has of late years slightly improved, for it is not quite so destructive as formerly. They manage these things better in France. There the work is not, as a general rule, tested by fire after the manner of our assays, but by the acid test, and it has always given satisfaction. No cutting or scraping is required by such a method; merely a few bottles of acid, the touchstone, and a set of test needles, are all that their system requires. Moreover, the work is not tested in the unfinished state like ours, but in the last stage of manufacture, and it may even be done on the way to the purchaser's, by calling at the Control Office for that purpose. The process is so simple and the means so accessible that it presents very little difficulty, and is not much different from ordinary business experience. The punches are few in number, and are so small as not to disfigure the work in its finished state when they are skilfully used. The laws relating to fraud and any infringement of the regulations are, however, much more severe than our own, being nothing less, we believe, than ten years' imprisonment for the slightest offence connected with fraudulent marking. There are some business men who think that the legislative restrictions bearing upon the subject we are treating of are unnecessary; that any interference with the freedom of manufacture is injurious to trade; and that it is essentially necessary, to a complete and full development of the various branches of the gold and silver trades, that the principle of non-interference by the Parliament of the nation in the general manufactures of the country, should be applied to these trades also. This principle is, we think, a sound one in many respects. We are not, however, quite prepared to go to such extremes, or to adopt such a wholesale condemnation of the hall-marking laws which our legislature has provided for the protection of those buyers of jewellery who choose to avail themselves of them; so that we cannot entirely fall in with this view of the question. Hall-marking would be all very well if it could be simplified and rendered more accessible to all classes and for all kinds of work manufactured from the precious metals. It is impossible to tell, from the appearance of articles made of gold or silver in their finished state, whether they are standard or not, on account of the artificial surface which most of them bear. In this respect nothing could be easier than to pass off spurious articles—or at least those of a far inferior quality to that represented—as genuine or of superior quality, if it were not for the protection the hall-marks are supposed to afford to the uninitiated or non-experts in jewellery transactions.

We would permit the manufacture of gold and silver wares in all their various qualities, that is, allowing an increased number of legal standards, from one-carat gold and upwards, at the will of the intending purchaser, with a system of *optional hall-marking* provided by law for all standards alike. This would give any distrustful person absolute security, by enabling him to purchase any carat quality with its fineness indicated by a Government stamp; whilst it would give the manufacturing goldsmiths and silversmiths freedom to alloy their gold or silver in any manner which practical experience might teach them was best suited to the various articles they produced, or to the tastes of their customers. They could then manufacture articles of various tints and with other effects, all of which are to be obtained by a skilful mixing of the different kinds of alloy.

We have said that we would permit the hall-marking of every quality when required, but we would make the marking voluntary, so as to secure perfect freedom in the manufacture. By this means we should have ample security for the public as regards their purchases, and free trade in the manufacture. The Government stamp should be applied by experts under Government control, and Goldsmiths' Hall abolished. We would have one executive to manage all the assay offices in the United Kingdom, that is, the assaying and marking should be subject to its will and control in all matters affecting the proceedings. The existing assay offices should be abolished where it is found that there is not sufficient assaying and marking being done to make the concern remunerative, or they should be removed to some more convenient town where an increased business could be done; and further, the marks or signs of quality now in use should be swept away, so far as they indicate the different halls and dates, together with the other cabalistic signs now separately impressed. We would like the duty mark also done away with by the final abolition of the duty upon all manufactures.

Moreover, we would advise the abolition of Goldsmiths' Hall and all the other subordinate guilds and corporations connected with hall-marking in the United Kingdom, and have an establishment in their place composed of experienced officials, entirely under the direction of one efficient organisation provided by the British Government, as we have said before, who would provide workshops in the different towns where the assaying and marking could be properly and effectually carried out. As a matter of economy, the same officers might be employed, and the same assay halls might be utilised, as far as practicable, under the scheme here suggested. As we have already observed, we consider the present marks incomprehensible to the majority of persons, even to those having an intimate acquaintance with gold and silver manufactures; much more, then, to such as are unacquainted with the double system of marking, such as is now practised: namely, the marks of the assay halls and those of the manufacturers, which are sometimes called private marks, and which are undistinguishable in the hands of persons not possessed of much knowledge respecting the various kinds which are now applied to gold and silver jewellery. To remedy this, we would advise one symbol or character to be employed as a *Government or hall mark*, and to be used alike in all the branch establishments for the purpose under discussion, simple in design, and to be readily distinguished from any other mark. Let it be emblematic of Great Britain, and recognisable by almost the most uninformed person in the land.

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* From the "Hall-marking of Jewellery Practically Considered."

Such a mark, we believe, could be found in the *Royal Coat of Arms*, removing the centre figures, the year of marking being substituted in their place; for instance, in the oval centre the figures 1883 could, as the representative of the present year, be readily inserted, and the quality mark or number of carats might be put in above. This would at once make a hall mark difficult of imitation, and answering all the purposes of the ones now in use. The *Imperial Crown* would make another good representative Government mark, of which a mere outline need only be impressed. In the centre of the crown there would be space enough for the quality figures, which would be indicated by the numerals 1, 2, 3, 4, 5, or by those which indicate the quality under the present system, viz., 22, 18, 15, 12, 9, &c. The bottom lines of the crown would form an admirable space for the date figures 1882. Again, the *Queen's Head* would form a suitable mark, significant in itself, well known, and very appropriate to the object in view. In this case, as in the two former ones, the quality and year of marking could be easily impressed upon some portion of the neck or under the chin of the representative figure. By carrying out these or similar suggestions, the marks would be reduced to two, viz., the *maker's mark* and the *hall mark*, and these would represent all the other marks which are now struck upon watch-cases, jewellery, and plate; they would, moreover, be far more simple to understand, and render the mark, as it were, a purely British institution. If it were found altogether impracticable to engrave all this upon one punch, on account of its smallness, such as might be required for some kinds of work, then the quality numerals could easily be impressed by the side of the hall-mark by means of a separate punch. We should then have only three marks instead of four, five, or six, as is sometimes the case under the present system.

With regard to the remedy now allowed by law of less than a quarter grain, we would have that increased to five parts of a thousand for gold, and eight parts of a thousand for silver. This would represent a remedy of thirty grains per pound for gold, and forty grains per pound for silver. And when we take into consideration the fact that the gold and silver purchased from the bullion dealers for commercial purposes is never absolutely fine, *i.e.*, pure, it is not too large a remedy to allow in the manufacture of jewellery. Gold used for the purposes of commerce generally contains about twenty-four grains per pound of impurity, and silver is sometimes found by the test of accurate assays to contain a little more. This impurity has to be allowed for in manufacturers' alloys, and is therefore a source of loss to them from a monetary point of view. The remedy here suggested would cover that impurity, which has now to be allowed for, and would not make the slightest difference to the purchasing public. But it would go a long way towards rectifying the evil we have so much complained of, namely, the defacing of the work, by allowing a sufficient margin in connection with the legal standard, so as to render the passing of the work through the Hall absolutely certain and safe.

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Prize Competition Open to the Watchmakers of the World.

EVERYBODY knows that the watch trade has undergone important changes these last few years, not only in the mode of manufacture, but also in the style of goods produced, and it is just the neglect of these changes that has brought the English watch trade into low water. This refers particularly to Clerkenwell, where trade is reported to be "sluggish," while Coventry manufacturers are busy—a fact we are very pleased to chronicle, as several firms of that city have recently shown great energy in grappling with the new state of affairs, and deserve every encouragement.

It is no use forcing watches on the market that are not in demand. Coventry has recognized this, and profited by it; while Clerkenwell, by stubbornly ignoring fashion, has nearly lost its trade. It is no use to growl over bad trade, and attribute the depression to bad times, and with folded arms wait for a revival. A revival of the Clerkenwell watch trade *as it has been* will never come; the times will not fit themselves to men; men must fit themselves to the times.

It is not for want of pointing out these signs of the times that the trade has come to grief; the so-called leaders of the *Clerkenwell* watch trade (they flatter themselves that they lead the *English* watch trade; but, thank God, their influence does not reach beyond their own narrow sphere), however, would not see, thinking that with their puny shoulders they could stem the tide. To say that they and their subventioned Institute and Journal are "sluggish," is a very mild expression.

During these so-called bad times, the importation from Switzerland and America to this country has increased; the former country has been exporting to the States in larger quantities than at any former period; during these bad times, factory after factory has been erected both in Switzerland and the United States. Is not this sufficient proof that the demand existed, and that the manufacturers and not the markets were dull. By a private letter, just to hand, from the Swiss centre of the watch trade, we are informed that two more large factories are being erected in the Jura on a very large scale; a factory, also, in that district, now employing 700 hands (400 last year), has had to refuse orders, being fully employed on orders in hand until next July, and *the bulk of these orders have been placed by English houses.*

May the new year bring new light to these Clerkenwellers, that they may see the errors of their ways before it is too late! "Zadkiel" has very ably pointed out in these pages how Clerkenwell can be saved.

We have been requested by sincere well-wishers to the English watch trade to do our share in stimulating the trade at this critical period, by advocating a fund of £100, to be given in prizes for two essays on subjects calculated to improve our industry. We are only too glad to accede to this request; and to practically demonstrate our sincere interest in the matter, Mr. A. Fischer, the proprietor, has placed £50 towards the fund at our disposal. We have no doubt the other half will be readily forthcoming, as it is assisting a good work. The smallest contributions will be gratefully received at the office of this Journal, and duly acknowledged in our columns, and the Editor will be pleased to supply any particulars, and receive suggestions as to subjects. We think that the going barrel watch (key and keyless), certainly *the* watch of the future, should be selected for one of the essays; we want someone to do for the going barrel and keyless mechanism what Grossmann has done for the lever escapement. For the second subject we should propose watch tools and machinery; but, as already mentioned, the Editor solicits suggestions hereon.' It was our intention to limit the competition to British subjects, but we were advised not to do so, as it might exclude important assistance from abroad; and what we certainly want is *the best*. This, however, will be a question to decide between the subscribers.

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Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 65.)

The earliest monument of Limoges work, is that to Geoffrey Plantagenet, "Le Bel," who died in 1150. It is preserved in the museum at Mans. The monument of Henri le Large, Count of Champagne, in St. Stephen's, at Troyes, was a noble piece of metal work, richly plated with silver and jewelled, independently of the beauty of its enamelling. This was begun about 1180. Perhaps still richer was that erected in 1201 or 1202 in the same church of Thibaut III.; this also was partly covered with silver plates on a wooden core. The recumbent figure and smaller lateral ones of members of his family were of copper, richly gilt and enamelled. These tombs were pillaged and destroyed in the revolution of 1790. A leaden font, rudely modelled and cast, ascribed to the twelfth century, still exists in the church of S. Evrouet in Normandy.

The metal work of Limoges did not cease to betray a Byzantine influence till the thirteenth century, when pointed architecture prevailed. With the development of this purely Northern and eminently graceful style all the sister arts speedily complied, although occasionally, as in the case of sculpture, not without certain restrictions and adaptations, to which they were obliged to accommodate themselves. These, it is true, had previously existed; the sculpture that had enriched the earlier rounded and traditional architecture having been equally "cabined, cribbed, confined" by the space allotted to such works, and the restrained requirements of architectural rule. A somewhat archaic rigidity of form and figure was the consequence, which nevertheless harmonised perfectly with its surroundings, and together formed an admirable whole. But in the course of the thirteenth century, we find a rapid development encouraged under the influence of S. Louis, and a tendency on the part of sculpture to emancipate herself from such architectural trammels, by an effort at more energetic action and varied disposal of the drapery

(*To be Continued.*)

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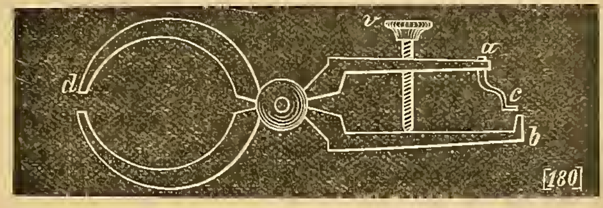
On Saturday morning, about £300 worth of jewellery was stolen from the premises of Mr. John M. Walter, a pawnbroker, of Aldersgate Street. About eight o'clock, after one of the assistants had taken the shutters from the window, he ran across the road to a baker's shop nearly opposite to purchase some hot rolls for his breakfast, and in his momentary absence the robbery took place. A turncock was at this time putting on the main near to the shop, and heard some glass smashing. As he looked round he saw two men run away up Fann Street, but was too much astonished to follow them. The proprietor of the shop was at once called, and an examination showed that a pane of plate glass had been broken with a large clock weight, and a card of valuable rings abstracted. Among about thirty-three rings stolen were a cluster of fifteen diamonds, a cat's-eye and six brilliants, some gold three-stone and one-stone brilliants, one coral and two brilliants, and about a dozen ladies' half-hoop rings, some set entirely with brilliants, while others had rubies, coral, or emeralds intermixed. Their value is calculated at £300. The morning was very dark, and the only description that the turncock can give of the men he saw running away was, that they had "billycock" hats on.

Height Gauge.

A correspondent in the *Revu Chronométrique* writes:—"I would acquaint your readers with a means of making a height gauge from an ordinary calliper, for the purpose of measuring therewith the height of cylinder and anchor arbors. The tool is very simple, and only about an hour's work is necessary to make it; it is cheap and very exact. It has served me well, and I am free to offer it with all confidence to my colleagues. It is represented in the following figure. The end of one arm of a calliper is cut off, and a hole drilled into it, in which a little brass or steel piece, forming a hook, is fitted as at *a*, and fastened. A thumb-screw *v* is placed in the middle.



"The tool is now ready, and its use simple; for instance, for replacing a new cylinder in place of a broken one, I use it as follows:—Having removed the cap, I place the jewel hole upon part *b* of the tool (which is fastened into a vice, to enable the operator to ascertain the measure with greater exactness), and by aid of the thumb-screw *v* I move the little hook *c* down until it stands opposite to the bottom of the cylinder wheel; this, as is well known, must stand in the middle of the cylinder notch. This having been done, I set the arbor of the little plug according to the length given by the tool, that is, I shorten the arbor of the lower plug until *c* stands exactly in the middle of the little cylinder notch, when the lower point of the cylinder has been placed upon *b*. The most important measure necessary for the cylinder placement is obtained in this manner.

"When the balance bridge has been fastened in its place, I ascertain the entire height or length of the cylinder, either with the pinion measure, or with the side *d* of the tool here described, and according to this measure I shorten the arbor of the upper plug. After these shortenings, only the turning and burnishing of the pivots remains, taking care to give them sufficient length, in order to touch the cap jewel.

"The intelligent watchmaker will easily comprehend the further uses and applications of the tool."

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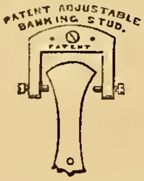
New Banking Stud.—A new adjustable banking stud has just been invented by an employé of Swinden & Sons, Birmingham, and patented by them. This stud is easily fitted to any lever watch. It is acknowledged to be the most useful banking stud yet invented. It is superior to all others, because it is adjustable, and because, by planting the screw (when the pin is in the notch) opposite the lever tail, any unskilled person can bank the watch correctly. Another point in its favour is, that it can be removed when cleaning the watch without interfering with the banking. Whereas in the old style the pins get damaged by brushing, and in gilding are invariably bent. The new banking stud is to be obtained direct from the patentees and sole manufacturers, Swinden & Sons, 27, Temple Street, Birmingham.



Trade Notes.

We call the attention of the trade to the "Watchmaking, Cutlery, and Jewellery Trades' Protection Agency." This is a very valuable institution, and will enable manufacturers and dealers connected with the various branches represented by this Journal to obtain all the advantages offered by Protection Societies without the usual vexatious routine and delay. The collecting department, at most moderate rates, is a most important feature. We should advise our readers to send for a prospectus to the Secretary, Mr. H. Lawrence Harris, at the head office, 32, Argyll Street, Regent Street, W.

The prizes and certificates gained by the students of the Technical College, Finsbury, of the South London School of Technical Art, and also by the candidates at the Technological Examinations held this year in the Metropolis, were distributed at Goldsmiths' Hall, Foster-lane, on Thursday evening, by Dr. Siemens, F.R.S. Sir Frederick Bramwell, F.R.I., presided. The list of prizes taken in watch and clockmaking has already been published in this Journal.

Mr. F. L. Davoine, Chaux-de-Fonds, Switzerland, has just published his Almanack for 1883 (29th year), containing 10,000 addresses of manufacturers of watches, clocks, musical boxes, jewellery, and allied branches in that country. It is sold at the office of this Journal, price 3s.

On Thursday, 11th inst., at 8 o'clock, a meeting will be held to discuss Mr. Ganney's paper on "The Desirability of Prohibiting London Trade Marks on Foreign Watch and Clockwork."

Watchmakers and jewellers are cautioned against taking cheques from a stranger, in payment of goods, without getting a satisfactory reference from their bankers or neighbours; a forged cheque for rather a large amount having been presented to a jeweller within the last few days, by a man about 40 years of age, height about 5 ft. 10 in., peculiar hooked nose, red neck, and dark complexion.

The American Watch Company, of Waltham, Mass., engraved No. 2,000,000 on an Appleton, Tracy & Co. movement, on Saturday, Nov. 4th. It took the company 23 years to make the first million watches, six years to make the second million, and it is estimated that the third million will be produced in two and a-half years. It will be the first watch in the world bearing that number.

It is stated that an invention which will effect important changes in the metal trade, not only in this country, but throughout the world, has been recently patented in Great Britain and most foreign countries, and is now being sold as an article of commerce. The invention consists of a new method of manufacturing alumina, by which nine-tenths of the present cost is saved, while it can be made in immense quantities in the course of a few days, instead of requiring nine months to produce it, as was formerly the case. The inventor is Mr. Webster, of Hollywood, near Birmingham, who has been engaged in the experiments since 1851, and only succeeded in perfecting his process about twelve months ago, after having expended nearly £30,000 in the experiments. The extent and value of the discovery may be gathered from the fact that a French syndicate have offered no less a sum than nearly half a million for the patent rights in France alone; and companies in the United States have offered £1,000,000 for the rights of manufacture in America, whilst the Belgians and Germans are also negotiating for the purchase for their respective countries. The ordinary method of making alumina is by precipitation, and the cost is no less than £1,000 a ton, whereas by Mr. Webster's process the cost is reduced to less than £100 a ton. When converted into aluminium, and alloyed with copper, tin, and other alloys, it produces a bronze metal which is considered to be superior to anything in use for ship fittings, steam propellers, and many other purposes, including the manufacture of artillery.

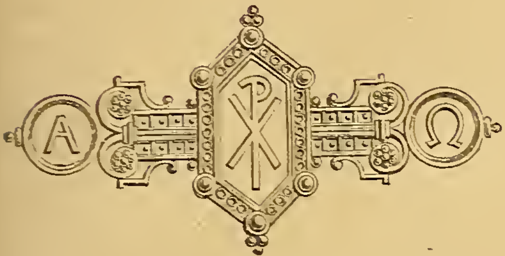
An International Art Exhibition, arranged by the Munich Artists' Association, will be opened at Munich in the spring of 1883. It will consist of works in painting, sculpture, and architecture, drawing, and works of art industry, if they are entitled by artistic invention and execution to rank as works of art. Works intended for exhibition must be sent to Munich, from the 1st to the 31st of May.

William Geo. Childers, 47, Canterbury Road, Brixton, was charged with obtaining money by false pretences.—Mr. Matthews prosecuted (for the Public Prosecutor), and Mr. Besley defended. It was alleged that the defendant borrowed money on duplicates for jewellery which had been pledged, but that the jewellery turned out to be below the value stated. The defence was that the transactions were bona-fide, and that value for the money was given. After hearing the prosecution, the Recorder decided that there was no case to go before the jury, and directed a verdict of acquittal to be given. However wrong, morally, the defendant may have acted, the transactions were clearly of a commercial character, even although the value of the articles may have been exaggerated.

A daring shop robbery was committed in Sunderland, and the thief got clear away with property to the value of £32. About six o'clock in the evening, Mr. Turner, pawnbroker, who has his establishment at the foot of Cousin-street, was sitting at his desk in the shop when he was startled by a crash at the window. The place was well lit up, and a quantity of jewellery, gold watches, &c., to the value of about £400 was displayed in the window. It instantly occurred to him that the glass had been broken, and he made a rush for the door. On getting into the street he observed a man running off with a case of gold watches and alberts, which he had extracted from the window. Mr. Turner at once gave chase, but the thief, who ran with considerable swiftness, outstripped his pursuer and escaped. Upon an examination of the premises being made, a brick was found on the pavement, under the window sill, with a corner of it newly knocked off, and this, it is believed, was used for smashing in the pane of plate glass. The case which was missed contained about £74 worth of gold watches and alberts. Several of the watches were picked up in the road and taken back by the neighbours. The thief, however, retained possession of about £32 worth of property—five gold watches and at least four alberts—and it is thought that he carried these off in a glass cover which belonged to the case, as it has not been found. Information was immediately given to the police, together with the numbers of the watches.

Supplement to the Watchmaker, Jeweller, and Silversmith, February 5th, 1883.

MONTHLY SUPPLEMENT OF DESIGNS.



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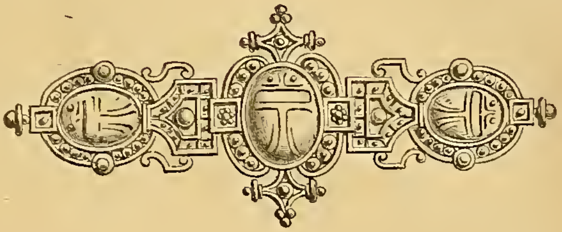

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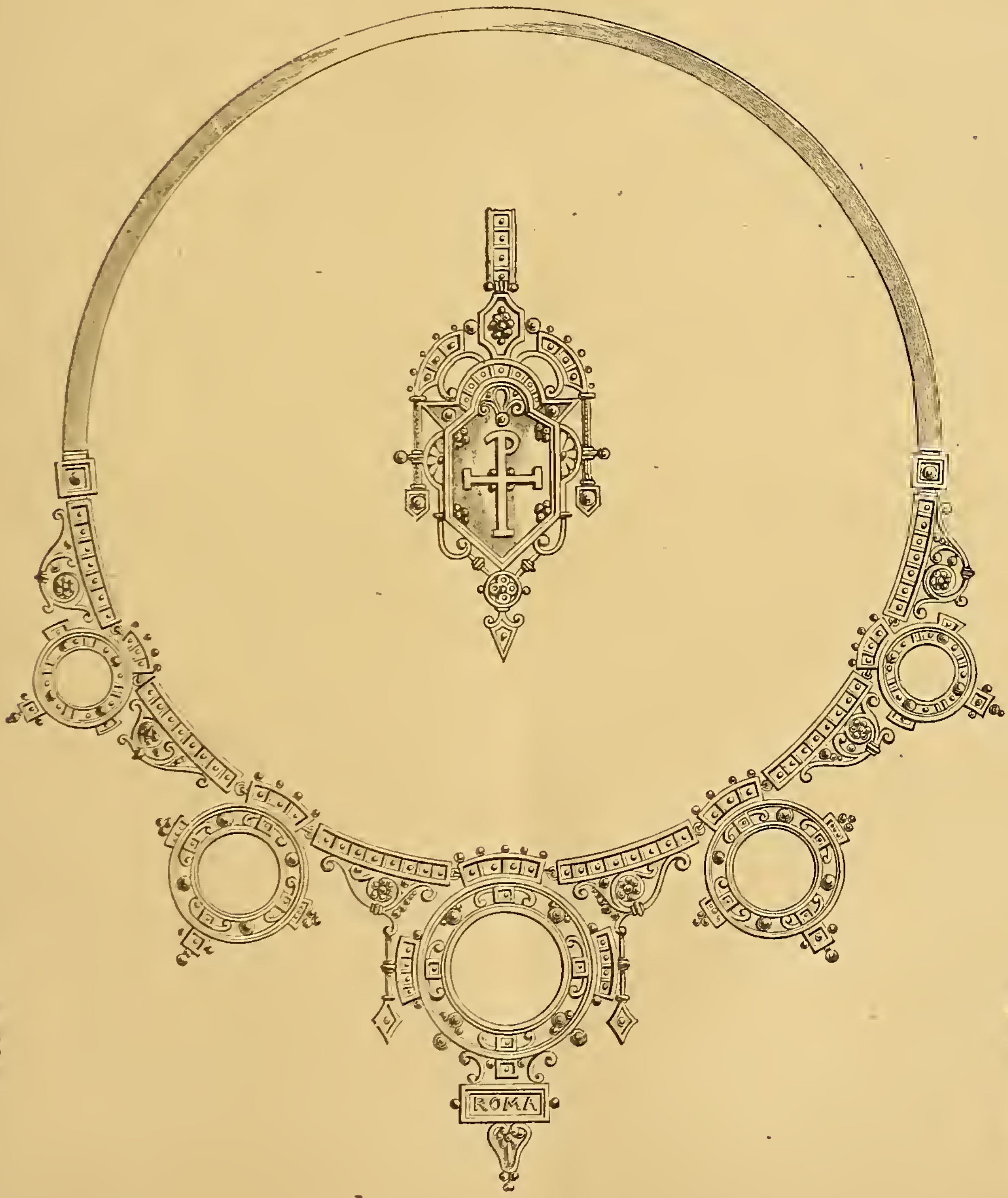

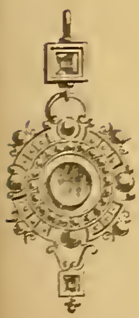

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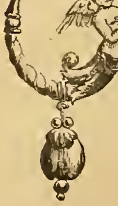

126.

THE WATCHMAKER JEWELLER AND SILVERSMITH

Devoted to the Interests of Watchmakers, Jewellers, Silversmiths, Opticians, and kindred Trades.

Entered at Stationers' Hall. Registered for Transmission Abroad.

No. 93.—Vol. VIII.] FEBRUARY 5, 1883. [Subscription, 5s. per Annum. Post Free.

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TWO ILLUSTRATED SUPPLEMENTS:—1. Designs for Modern Jewellery. 2. Antique Rings and Ornaments.

The British Horological Institute.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—As the proceedings of the Horological Institute have from time to time been discussed in your columns, and as your editorial of last month (p. 90) distinctly implies that a lack of energy is one of our characteristics, I am induced to occupy some of your valuable space in detailing the objects for which the Institute was founded, together with the position I myself have taken in it of late years.

I was elected a member of the Council on Dec. 30th, 1864, but was unable to serve at that time, owing to other engagements, so had to content myself with occasional visits until the commencement of 1880, when I was again elected.

Shortly after this, the City and Guilds Institute completed negotiations which had been pending with the Council, and generously made a grant of £350 a-year for three years for the maintenance of classes for teaching practical and theoretical horology; also they made a further donation of £500, £250 of which was to be devoted towards reducing the debt on the building, and the remainder for the purchase of tools, work benches, &c. The expenditure of this latter amount, together with the selection of the teachers, was entrusted to the following gentlemen: Messrs. Bacon, Glasgow, Jackson, Kullberg, and Rigg.

I have already referred to the nature of the work done at these classes, in the June number of this Journal, p. 172. Since then I acted as one of the judges in making the awards to the most proficient pupils in both day and evening practical classes (theoretical knowledge not having been taken into account), and the nature of the work submitted fully bore out the correctness of my remarks. Movements of various styles were being worked up into watches, evidently with the idea of being preserved as mementoes of the connection of their owners with the Institute. I was defeated in my attempt to obtain from the pupils at the evening class specimens of uniform work, made to given sizes, as the teacher failed to apprehend my meaning, although the conditions were supplemented by an explanation in your columns.

The Council are fully alive to the necessity of insisting on a high standard of excellency being sustained before a silver medal is awarded, and a special series of resolutions were passed at our last meeting.

It may be interesting to your readers, and possibly beneficial to the Institute, to have its design and objects clearly placed before them; and I know of no better way than to reproduce the revised rules agreed to at a special meeting convened for the purpose May 11th, 1880:—

The design of the Institute is to promote the cultivation of the science, and to teach the practice of Horology.

Its views are directed to the following objects:

1. The formation of a Library, Reading Room, and a collection of Tools, Models, and Machines.
2. The delivery of lectures and the reading of original papers connected with the art of Horology.
3. The formation of classes for the study of the various branches of knowledge connected with the theory and practice of Horology.
4. The encouragement of merit, either in invention or workmanship, by suitable rewards and marks of distinction.
5. The issue of the *Horological Journal* monthly.

Members elected since August 1st, 1880, pay an annual subscription of 21s., and associates 10s. 6d.; their privileges are as follows:

1. All members shall be entitled to admission to the Reading Room of the Institute; to the use of the Library, under such regulations as may be made by the Council; to admission to all meetings of members; to one extra ticket of admission to lectures, &c.; to one vote on each question at a general meeting.
2. Members may inspect books containing minutes of general and Council meetings for one month prior to each annual or half-yearly meeting.
3. Each member shall be entitled to a copy of all printed papers issued by the Institute, unless especial exception of any such documents has been made by a general meeting.
4. Associates shall have all privileges of members, except a voice in the management of the Institute, and the power to vote at meetings.

It will thus be seen that the objects of the Institute are strictly educational and scientific, and its leaders have hitherto, and perhaps wisely, denounced any introduction of the commercial spirit; and it is doubtless for this reason that the great body of workmen have not identified themselves with it.

On Dec. 13th, 1869, a paper was read by Mr. Herrmann, the then teacher of the drawing class, on the following subject: "Why does not the British Horological Institute receive the general support of watchmakers? with suggestions for its improvement." The chair was taken by J. A. Lund, Esq.

At the conclusion of the paper (I now quote from the report in the Journal), a discussion upon it was invited. We give here a short account of the opinions of the principal speakers.

Mr. Poole said the Institute would receive better support if the Journal were more practical. Its present abstrusity prevented the general workman from benefitting by it. The subscription also excluded many from becoming members, because they could not afford twelve shillings a year. If it were about five shillings, it would enable many to join it. More meetings ought to be held, and lectures should be delivered in a larger room, the present accommodation being very insufficient. A great injury was done to the trade by forged names. Inferior country-made and Swiss watches were sold as London-made; he had himself been victimised in this way. Scientific instruction was of little advantage to workmen. It is not from the want of science that workmen get into difficulties, because many things defy rule, but more through oversight, such as forgetting to put oil, &c.

I also remember saying, although not reported, that the Institute would be more appreciated by workmen if they felt it was doing them some definite good by keeping the Clerkenwell watch trade together; and that this might be accomplished by making a leading feature of the fact that the best work was actually made up in Clerkenwell, and not at Coventry, or on the premises of advertising retail houses.

At the adjourned discussion the Chairman alluded to this portion of my remarks as follows:—"One speaker instituted comparisons between Clerkenwell and Coventry, and other country seats of the watch trade. This was a pity, as our Institute aims, not at being the London, but the British Horological Institute; and therefore we desire, and need, and seek, their good, and not their ill feeling. Another speaker recommended the production of a 20s. watch, and the creation of a Co-operative Watch Company, neither of which recommendations bore upon the question under debate, because *with the exclusively commercial part of any question the Institute has nothing whatever to do.*"

I think, Sir, that the foregoing extracts, although taken from a report of a meeting held more than thirteen years ago, very fairly represent the position and policy of the Institute, and I now desire to review the report of my own remarks, which did not give satisfaction at the time, and have several times since been animadverted upon, more especially those relating to technical education.

In the first place, I would say that I am not responsible for the correctness of the report, and was too much engaged at the time to enter upon a controversy, as invited. I was speaking from a commercial standpoint, and urged that educating workmen would not *of itself* bring more work to Clerkenwell, because a sufficient amount of intelligence existed among the masters to superintend the execution of very much larger orders than they seemed likely to get. With reference to many things defying a rule, I simply meant that known correct proportions of escapements, or the size and number of turns in a pendulum spring, or the weight of a balance, are constantly obliged to be disregarded to suit the movements to which they are applied; because watches are made up with the idea of getting a living out of doing so, and furthermore, it is impossible to alter many things after they have once been done in a certain way. For instance, on Feb. 28th, 1877, Mr. Glasgow read a most instructive and interesting paper on springs and spring-making. He gives directions to drill the hole in the stud, so that the spring will run into it without altering its shape, and consequently require no bending. This is all very well; but I would like to know how many springers actually made their own studs; they are generally obliged to work to conditions over which they have very little control. Again, Mr. Glasgow says—and very properly too—"On no account, however, make a Brequet spring to a watch with an index." Now, the public *will* have indexes in very many cases, and at the present time more Brequet spring watches with indexes than ever are being made up, consequently the commercial necessity rules the day.

I also went on to say, that assuming a watch to be constructed on the most perfect principles, its performance was likely to be jeopardised by a workman forgetting to oil one of the holes, and that no scientific attainments of *themselves* would ensure the return of prosperity to the trade. Since then the tide of public opinion has strongly set in in favour of technical education in all trades, and the old apprenticeship system, to which I have so frequently referred, has to all intents and purposes become a thing of the past; therefore, I would urge upon learners desirous of improvement, to promptly and thankfully avail themselves of the advantages offered by the practical classes at the Horological Institute.

It is also of the utmost importance that they satisfy the requirements of the examiners of the City and Guilds Institute, which has generously renewed the grant for a period of three years, as announced at our last annual meeting.

I must now close this voluminous paper.

JAMES U. POOLE.

The Worthies of Horology.

By C. Stuart Murray.

IX.

We are now in the first month of the new year,* it may be, therefore, worth mentioning, that in the early years of horological art a custom prevailed of making presents to distinguished persons of clocks and watches, and that the best artists horological of that time were accustomed to exercise their finest skill upon such work. In my hunting about among the dusty records that bear upon this subject, I have found a few notes about New-year clock gifts: what is more, these gifts were most unscrupulously exacted by 'princes, potentates, and powers," from those surrounding them. The latter, however, mostly recouped themselves by fleecing their tenants and retainers: the said tenants, by the way, did to themselves as they wished others to do unto them, by making up their lord's black mail exaction out of extra labour from the poor serf-tillers of the soil. This plundering practice went through all the European Courts and "society;" in most places it is "understood" down to the present day.

Holbein made a drawing of a clock which Sir Anthony Denny presented to Henry VIII. as a New year's gift, whilst his daughter and successor was notorious in her propensities that way; but her's—womanlike—were principally in dresses. When she died, she left hundreds of them behind her. Her greatest "draw" was on New-year's day, 1584, the "expectations" having been well beaten up long before; and woe to the lord or lady who showed themselves, as the joke has it, "backward in coming forward." So many offerings of money, caskets, trinkets, brocades, and the richest wearing apparel, did she receive upon that day, that they made up a long State roll, or catalogue. Not only were peers, peeresses, bishops, and officers of high rank, clipped of their wool for the occasion, but even the Royal Household servants, down to the cooks, had to send something that was agreeable to "Good Queen Bess"! But it is only fair to say that she made some returns—returns in gilt plate to the amount of four thousand eight hundred and nine ounces, exclusive of what she presented to the foreign ambassadors. She had a New-year's gift from the Earl of Leicester in 1571, which she was said to have long prized before any other. That was a richly-jewelled armlet, which had "in the closing thearof a *clocke*, and in the forepart of the same a faire lozengie dyamond without a foyle, hanging thereat a rounde juell fully garnished with dyamondes and a perle pendaunt."

There is every reason to believe that both the clock that Sir Anthony Denny presented to Henry VIII., and the one in the jewelled armlet of his daughter, Queen Elizabeth, were both made in England. I am led to this conclusion from the fact that what is known as the Reformation in England, by which Henry had overturned the papal authority and set it at defiance, had created such intense feelings of hostility towards this country in the watchmaking part of the Continent as to preclude the probability of any clockwork having been done there. Hence, we may safely conclude that both clocks were made in London, although I have been unable to find out the names of the Horological Worthies who made them. One thing, however, I did discover; that was, who made the old, old clock that kept time "ages ago" in Windsor Castle. That Worthy rejoiced in the name of Knight. I have been looking over the roll of members of the Clockmakers' Company at its incorporation in 1631, but the name of Knight is not among them. If he were living at that time, he might not have joined the Company; probably he was born after the date mentioned. In the Morgan collection is a splendid specimen of a clock which, from the appearance of the workmanship, is judged to be of Augsburg manufacture. There is no name upon it, but it is held to have been made sometime between the years 1550 and 1575, by some celebrated German clockmaker. It is a table clock, in the form of a low base or pedestal, six inches square and two and a-half inches high, resting upon four couchant lions, one at each corner. This base, within which is the movement, is ornamented with a moulding round the top and bottom, and at each angle there is a female figure holding flowers and forming a corner pilaster. The sides are finely chased in bold relief, representing the liberation of Eurydice by Orpheus. These two mythical names will require a little explanation here. The name of Eurydice—pronounced as four syllables—is more familiar to us than most of the heathen goddesses, chiefly, I think, through having had ships so-called. In the classic mythology there are no fewer than thirteen of them, the first being a very "bad un" indeed; but she was not the one meant above. The "bad un" was the wife of Amyntas, King of Macedonia, by whom she had three sons and one daughter. In these days she would have been in the Divorce Court very speedily, on account of her naughtiness. Her troops deserted her, and the conqueror, having got hold of her, gave her the option of dying of poison, the sword, or the halter; but die she must. She chose the halter, and in a very few minutes the world was well rid of her. The second Eurydice was the wife of the poet Orpheus, and, to use a Shakesperian horological quotation, "and thereby hangs a tale." Here is some, but the whole of it is too lengthy for this place.

Orpheus is generally set down to be a son of Apollo and the Muse Calliope. This particular Apollo—for there were four of them—was the god of all the Fine Arts, of music, poetry, eloquence, &c., and a somewhat non-moral deity into the bargain. Calliope was similarly gifted, and was supposed, besides, to be able to play on any musical instrument. No wonder, then, that the son of such parents should be both a poet and a musician, which he was. The classic writers, especially Ovid and Horace, draw a very long bow indeed, about the musical miracles of Orpheus. It is said that when he played and sang, the rivers ceased to flow, the savage beasts of the forests forgot their wildness, and all nature's work was suspended to listen to him! and was charmed accordingly. As may be supposed, he was much sought after by the nymphs of the time, but he ultimately married Eurydice, the only one who ever made an impression upon him. Their honeymoon was barely over when their troubles both in this world and another one began. In flying from a wicked suitor she was bitten by a serpent that was lurking in the grass, and so entered the infernal regions. Orpheus was inconsolable for her loss, and with his lyre followed her, gaining an audience easily from Pluto, the King there. Upon telling the sad story of his bereavement, both Pluto and Proserpine, the Queen, were much moved therewith, especially Proserpine. Pluto at length consented to restore Eurydice to him on condition that, when returning to earth, he should forbear looking behind him. He at once agreed to this, and hastened on his way rejoicing, with the knowledge that when he reached the borders of the Plutonian regions, and was close upon those of the earth, he was safe. Journeying along, however, he forgot himself, and turned his head to gaze upon his beloved Eurydice, just as he was reaching the earth. That gaze was fatal. He saw her, but only for an instant, as she vanished from before his eyes for ever. And this is what is meant by "The liberation of Eurydice."

When Orpheus was in the infernal regions, he so charmed them all there, that the stone of Sisyphus stood still instead of constantly rolling; Tantalus forgot that thirst that was never to be quenched; and even the Furies relented! I will add that this tale is told here for the special information of gold and silversmiths, as they are often called upon to chase out classic designs. They cannot all, especially the younger artists, be acquainted with the stories which they have to illustrate in their work, and until art-education has become more thorough than it is at present, such explanations as I have given here must be productive of knowledge. I have always strongly held the opinion that when an artist has a mythical design to reproduce, in whatever material he may be engaged upon, he should know the whole story. He will then be working, as it were, in a better light, and will *feel* the living principle that is guiding his embodiment. That such information may be given in exceptional cases, but in exceptional cases only. That it is true, as a rule, I have very reliable reasons for denying.

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* This contribution was intended for the January issue, but it came to hand too late.

The Horological Worthies of the latter part of the sixteenth and the early years of the seventeenth centuries, must have "stood" well with the dramatic writers of the day, and with poets generally, English, French, Italian, and German, and even from the earliest downwards. We find Chaucer, the father of our poetry, saying—

> "Full sikerer was he crowing in his loge,
> As a *clock*, or any abbey orloge."

That meant that the clock and cock-crow might be surely depended on. Again, we find Ben Jonson, in "The Silent Woman," a play that was first acted in 1609, giving the following description of a fashionable beauty of the period:—"She takes herself asunder still, when she goes to bed, into some twenty boxes, and about next day noon, is put together again, like a great German clock, and so comes forth and rings a tedious larum to the whole house, and then is quiet again for an hour, but for her quarters." That scathing sarcasm would sound strongly from the stage, even in these days. "O rare Ben Jonson!" How skilfully the clock was used to compare the fine lady by. In the drunken brawl scene in "Othello," where Iago is slandering Cassio to Montano about Cassio being constantly drunk, Montano asks:

> "But is he often thus?"

To which Iago replies:—

> "'Tis evermore his prologue to his sleep;
> He'll watch the horologe a double set,
> If drink rock not his cradle."

The reader probably recollects that Iago purposely persuaded Cassio to drink, so as to damnify the latter in the eyes of their general, Othello, and so on downwards. The "double set" of the *horologe* plainly meant the twenty-four hours, showing that the dials were the same as now, having only twelve hours upon them. In another scene we find Bianca saying to Cassio, who was her lover:—

> "What! keep a week away?—seven days and nights?
> Eight score eight hours? and lovers' absent hours,
> More tedious than the dial eight score times?
> O, weary reckoning!"

In "As you like it," we read:—

> "And then he drew a dial from his poke;
> And looking on it with lack-lustre eye,
> Says very wisely, 'It is ten o'clock;
> Thus may we see,' quoth he, 'how the world wags;
> 'Tis but an hour ago since it was nine,
> And after an hour more 'twill be eleven;
> And so from hour to hour we rot and rot,
> And thereby hangs a tale.'"

There was a Horological Worthy in Augsburg whose name has been accidentally omitted in the description of a splendid example of his work, although the context gives a certain substratum upon which to venture upon a guess—but only a guess—in the way of conversation; certainly not for publication, as I might just as likely be wrong as right. In the event of being wrong, I should lay the foundation for an error that could not be effectively rectified hereafter. The clock about to be noticed was made towards the close of the sixteenth century, and is called a *bronze doré* table-clock. Competent judges have declared the horological mechanism to be elegant and even wonderful in its various complexities. It is in the form of a celestial globe, and from that cause it is partly astronomical.

The late Mr. Vulliamy devoted much time and skill in repairing and endeavouring to find fathers for the singular "waifs and strays" of ancient horological art. He had one about the year 1849, which greatly interested him, and whose parentage he would gladly have unearthed. It, too, had an external globular appearance,—in fact, it looked simply a ball suspended by a ring; nobody upon looking at it would think for a single moment that its own weight was the motive power that kept it both going and striking. The winding-up was done by placing the hand under the ball and raising it up. The ring by which it is suspended is fastened to a square steel bar, which bar passes through the upper part of the globe into the frame or body of the instrument, whilst above the frame to this bar is fixed a small pulley. Inside of the frame are two drums, in every respect duplicates of each other, one being placed on each part of the bar, and each drum having in it a spring, the action of which will be mentioned presently. The drums are each furnished with an end wheel with click and ratchet mounted in a similar way to that which connects the great wheel of a clock to the barrel. The relationship between the steel bar and the train is effected by a chain which passes over the pulley, and an equal number of times round each drum. In such a manner is the ball attached to the bar. The two wheels in action with the drums communicate motion to the going and striking parts respectively; and in this way the weight of the whole mechanism, with the exception of the bar and pulley, is the momentum which causes the clock to act. When the ball has descended as low as the chain will let it, the reason why raising it on the square bar should answer to its winding-up will be readily understood. The ingenuity shown in the way that the chain is taken round the drums is worth noticing. It is managed by the springs of the drums in conjunction with the ratchets and clicks doing their usual work. The springs cause the drums to revolve in the contrary direction, and so to take up the chain as it becomes disengaged by raising the ball. This clock is a great curiosity of its kind, and where it is now, or whether in existence at all or not, I cannot absolutely say. One would think that the contriver of such a rare piece of mechanism—a going and striking train within a ball, would have been sure to have had much made of it. But that is not so; had it not reached the hands of a collector of such unusual mechanisms, some five and thirty years ago, it might have found its way to the marine store shop, and then to——oblivion.

◆

The *Cumberland Daily Times*, of America, says:—"One of the novelties recently introduced by our business men here is a small engine and boiler used by Mr. W. F. A. Woodcock in polishing watch jewels, which are imported by him in the rough direct from Europe. The most surprising feature of the whole arrangement is, that a small gas jet will generate enough steam to run the entire machinery, which is so completely under the control of the operator that he can stop the engine at will, and in a second's time. The boiler and engine occupy a space of about two cubic feet, the boiler being in an upright position, and about two feet high.

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 82.)

"Man is a tool-using animal. Weak in himself, and of small stature, he stands on a basis, at most for the flattest-soled, of some half-square foot, insecurely enough; has to straddle out his legs, lest the very wind supplant him. Feeblest of bipeds! Three quintals are a crushing load for him; the steer of the meadow tosses him aloft like a waste rag. Nevertheless, he can use tools, can devise tools; with these the granite mountain melts into light dust before him: he kneads glowing iron as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without tools; without tools he is nothing, with tools he is all."—Thomas Carlyle, *Sartor Resartus.*

Watch Manufacturing.

I suppose there are very few writers in our language, especially of modern times, that have not paid a high tribute to that department of human ingenuity which is especially manifest in the devising and using of tools, and all seem to vie with each other as to who can bring the highest tribute of praise; for in every age the whole subject has been the channel of such incalculable benefits to the world, that a persuasive pen will always find ready access to our sympathies in commending it. Doubtless it is reserved for Holy Writ to speak upon this subject in a manner that others cannot. It is written (Exodus—Chap. XXXV. v. 30 to 33)—"See the Lord hath called by name Bezaleel, the son of Uri, the son Hur, of the tribe of Judah; and he hath filled him with the spirit of God, in wisdom, in understanding, and in knowledge, and in all manner of workmanship; and to devise curious works, to work in gold, and in silver, and in brass, and in cutting of stones, to set *them*, and in carving of wood, to make any manner of cunning work." The divine condescension and encouragement here recorded is by far the highest enconium ever paid to mechanical skill; I suppose the inspired volume itself does not contain a parallel, and in an age when we are conferring the honour of Knighthood on our Whitworths and Bessemers, chiefly because they have been enabled "to devise curious works," and when our young men are busily engaged in technical studies, and the whole nation seems eager to advance in these things, and unsparingly charges itself with neglecting them, is there not at such a time an unusual interest in the study of such a record, especially when we consider it was written in times so remote.

Since I commenced writing this Essay, I am pleased to meet in the pages of this Journal my old friends, Mr. Poole and Mr. Ganney, also "Zadkiel;" and I have no doubt we shall be able to discuss our little differences of opinion, in measured terms, to our mutual advantage.

There has always been among outsiders great interest attached to our craft; to some it seems shrouded in impenetrable mystery, while others seem disposed to surround it with a halo of light; when the indefatigable Paley would give us a most striking instance of ingenuity and design, he instances a watch, and though since his time great advances have been made in arts and science, yet I believe to-day there is no dead thing so like a living thing as a watch or a clock, and it never posessed greater importance than at this hour.

Watch manufacturing opens up a very wide field for our enquiry. We might very profitably employ the space at our disposal in endeavouring to trace cunning in our right hand to the teaching of him who made the time-keepers in the firmament, and have not some of the processes for working in gold, and silver, and brass, and in the cutting of stones to set them, been bequeathed to us by Bezaleel. Or if we were to trace the history of our industry in this country through the last three centuries, I think we should find our sympathy with English art had been perceptibly enlarged, while imperceptibly, we should learn a lesson in the history of English commerce, and touched upon some of the causes that have contributed to the progress and greatness of our country. The history of machine tools in their connection with horology has yet to be written, and the great revolutionary power that is being worked by them is a theme for the earnest student. But I have matters that are more pressing, and in treating upon them I shall endeavour:

1st—To show minutely the system of manufacture at present adopted in Clerkenwell.

2nd—I will make certain comparisons between English and American watches and their system of production.

And, finally, suggest certain special features that a new enterprise in London must possess in order to compete successfully with existing watch manufacturing companies.

Richard Whittaker.

Erratum.—Page 81, paragraph 6, in last issue, for 1879 read 1878.

The London Trade Marks upon Foriegn Work.

Upon Thursday, the 11th ult., a discussion was held at the British Horological Institute, upon a paper which had been previously read by Mr. H. Ganney, entitled, "The Desirabiliy of Prohibiting London Trade Marks on Foreign Watch and Clock Work." Mr. Ganney laid it down that there were many ways of looking at the question. One that most commended itself to Clerkenwell watch manufacturers was, that all goods sold with a London trade mark that were not made in London was so much money taken out of their pockets. But another view was of a different nature altogether. That may be summed up in the affirmative question of "how much employment and profit are obtained in Clerkenwell from foreign work, which would have had no existence if complete dependence on Clerkenwell for the London watch and clock trades was the rule instead of the exception?" He contended for the maintenance of things as they are, because the advantage in favour of that argument was to be found in the millions of watches which came from all quarters into London. That advantage consisted in the constant repairing of those watches, which was a more extensive business than the manufacture of them ever had been. So much half-finished and badly-arranged work belonging to those that came from abroad, left the capable watch-repairer no time, nor gave him any inducement to make anything new. Keyless watches, too, were threatening to complicate the situation, on account of the careful cleaning and supervision required from the workman. The promiscuous trading in clocks and watches was becoming both a public and a private nuisance, and it might, therefore, be asked if it was not within possibility to so reorganise the trade, that identical interests could be secured. He indicated that no person should be allowed to deal in watches who could not take one to pieces, remount it, set it going again, "and give a fair estimate of its peculiarities." In support of this proposition, Mr. Ganney, as we think unhappily, drew upon the London cabmen, who must prove by examination that not only ability in driving, but a knowledge of London streets was necessary to obtain a license to drive. It appears to us that it would have been more dignified to have left the cabman upon the rank, and have gone upwards towards law and medicine for parallels. Horology seems to most of its disciples to have a sufficiency of evils to contend against, without the despairing hope of falling down upon "Cabby" as an illustration of high qualifications. We think that the *simile* of a doctor diagnosing a case of internal disorder, advising upon it, prescribing, and restoring the patient to health, would have been more in accordance with the splendid traditions of the long line of horological luminaries than the comparison that was chosen. We give this as the metaphorical "nod" that may be as good as a "wink" in the hereafter.

The next aspect of the case was presented in the mention of the "good old times"—all times when old are good—when the modest shops of capable and conscientious London watchmakers directed and organised Clerkenwell horological talent; and that then that district flourished. Mr. Ganney here gibbetted the modern watch dealer as high as Haman.

"Since the advent of an altogether different class of being, the advertising watch vendor, whose business is dependent on the bill-sticker for his patrons, and meretricious show in the appearance of goods for their selection by them, we have not flourished, and never shall until the public understand that the partnership between the London watch vendor and the Clerkenwell horologist has been dissolved; and those who require specimens of his skill must apply to headquarters, or accredited agents in the provinces or abroad."

With respect to "the advertising watch-vendor," so scathingly—or what is meant to be scathingly—denounced by Mr. Ganney, we can only point inwards, and ask—where is the "vendor" who does not advertise? From Cornhill to Pall Mall, whether in newspapers or upon bricks and mortar, there the advertisements are to be found—found, too, under the names of firms who rank, not only as among the leading horologists of London, but of the world. And we may wonder where their trade would be by this time if they did not? Our own firm conviction is, that there is not "half enough" advertising done, and that if Clerkenwell had had an efficient advertising force in operation during the last thirty years or more, Clerkenwell watchmaking would not now be the subject of "weeping and wailing, and gnashing of teeth." We have heard of children crying for the moon; Mr. Ganney might join in that chorus, draw the millenium into the groaning—and wait till it comes in the flesh,—as rail against advertising trade in these days.

Mr. Ganney went on to comparative details, which need not be criticised here, and gave expression to an astonishing statement, thus—"Prevent the London name being applied, and you drive into the bankruptcy court, or honest courses, those who serve no interest but their own, and whose public use is such that any one can buy for half the money, at any side street near their establishments, the fellow watch, and and by the same actual maker!" We think that this opinion may be safely left to the judgment of the large factors and importers who are established in London, and who may take a somewhat merry view of it. Mr. Ganney would fine and imprison any foreigner who used the name "London" on foreign work, and would keep such punishment as a standing prohibition. He says that "there would be no more difficulty in enforcing such a proposition than in prosecuting those who forge or imitate hall-marks, which only experts understand." However pleasing and desirable it would be to have only London marks upon London work, the arguments of the difficulty would take up much more space than any journal of the trade is ever likely to have at its disposal.

The discussion took place on the 11th of last month, of which the following may be taken as a summary of what was said.

Mr. Glasgow, one of the Vice-Presidents of the Institute, occupied the chair, and opened the discussion by referring to Mr. Ganney's argument; namely, that he considered it a fraudulent practice in putting the name of "London" upon watches made in Birmingham or Coventry.

Mr. Bickley had no doubt but that the name of "London" gave a value to the traders in watches. London was the fountain-head of all improvements in the art, and all the great makers lived in London in the olden times. He thought that watchmaking had not kept pace with other advances of the country during the last thirty years. Cloth and other articles were made by the men who sold them; the farmers' wives wove it at home, and their husbands sold it in the different markets. But the march of machinery had altered all that, and the village weaver was now unknown. Turning to watches, Mr. Bickley said that in these days the man who sold the watch was supposed to be the maker; and the speaker went on and said that the main object of the supposed maker was only to sell as much for his own benefit as possible, without any reference whatever to the man who made the watch. If one went into the draper's shop and asked for Hoyle's prints, they were produced and sold as such, with Hoyle's name upon them. Following that plan, he contended that whoever made the watch should have the credit of it. In country towns, in days gone by, the clockmakers there put their names upon their clocks because they made them. Now they had taken to selling what they never made. The question was, how to alter it. Enterprise, capital, and machinery were wanted to break down the principle of sellers selling watches that they did not make. The public should insist on having a *bona fide* London-made watch. No trade should be tied up in a straight waistcoat. He did not see how to prevent the London name being put upon watches that were not made in London. He argued that the only way to keep up the value of the London name was to make something better for the price than was made now. The status of the trade must be raised—the social status for superiority in workmen. He thought that the suggestions which he had thrown out would answer far better than any restrictive measures whatever.

Mr. Gayden thought that Mr. Ganney, in a part of his lecture, unjustly ran down English watches. The speaker had lately seen a Coventry watch that would compare favourably in every way with any London-made watch. Mr. Ganney spoke highly of both American watches and the American system of manufacture. But the Americans copied from the Swiss, and obtained pallets from them.

Mr. Ganney: Not now.

Mr. Gayden had heard that hundreds of thousands of jewel-holes had gone to America from Switzerland.

Mr. Ganney would not admit it. He went on to speak of the impossibility of setting up any system of protection so long as the public were such fools as to buy from the advertising people.

Mr. Stuart Murray craved permission to say a few words upon the question from the watch-wearer's point of view. When a man went into a shop to buy a watch, he was generally too busy, and the shopkeeper was too busy, to enter into any conversation about whether the watch was London-made, or whether it was not. What the purchaser generally asked was, Could the watch be relied upon? He was answered that it would give every satisfaction for the price. Mr. Murray had often been consulted by intending buyers of watches, and he found that, with the exception of the leading names in the retail trade, people knew nothing whatever about Clerkenwell. If Clerkenwell wanted to compete with the shopkeepers, then its watch manufacturers must form themselves into a great confederacy, subscribe their funds, and by means of advertisements in the newspapers, and posters all over the walls of the town, make themselves known to the public. (Hear, hear.) If they wanted a retail trade, unless they did something of that kind, all their meetings, and all their talk, and all their discussions in that room would only end in so much smoke. (Hear, hear.). People wanted educating upon such matters, and there was no other way of doing it except by publicity.

Certain people knew where to go to when they wanted a high-class watch, making sure that they would get in the article for which they asked, full value for their money. But the great mass of the public knew nothing of that. Another thing: he might tell those who were not aware of it, and that was a word about watch warranties. It has been decided in law that such warranties as were mostly drawn up were not worth the paper upon which they were written. They were no warranties at all.

Mr. Poole thought that a remedy for mis-naming watches might be found in granting a special license when the word "manufacturer" was used. He believed that a large section of the public was educated in respect to the purchase of a watch, but not the great mass of the public. At present the retailers were masters of the situation. He mentioned co-operation; the co-operative spirit was abroad wherever they looked, and he was bound to say that at the stores fair prices were put upon a watch. What was wanted was a spirit to deal with manufacturers; he believed that legislation in the matter would fail.

Both before and after Mr. Poole's observations, the proceedings diverged into a conversational character, about the method of manufacture, the quality, and the prices; but the consensus of opinion seemed to be that the remedy for the evil complained of must be found among London watch manufacturers themselves in making the superiority of their workmanship known to the public direct, so as to induce a general demand for the London-made watch. A Clerkenwell co-operative system was spoken of as the only way to effect the object desired.

Mr. Glasgow did not believe in the co-operative system, whilst he looked upon machinery as entirely out of the question. Until watchmakers combined in a social sense, he thought that no good could be done. As it was, they were too jealous.

Several gentlemen said that they had never experienced that jealousy.

Mr. Dunn, Mr. Wright, Mr. Willis, and other members took part in the proceedings, which were brought to a close by the usual vote of thanks to the Chairman. Whether any practical results will ensue from this discussion would be too curious to speculate upon at present.

British Horological Institute.

Half-Yearly Meeting.

The half-yearly meeting of the Institute was held on Tuesday evening, January 16th, W. Chapman, Esq., one of the vice-presidents, in the chair. Mr. Britten, the Secretary, read the Balance Sheet and Report, the following extracts from which will be found to contain the most important items of information.

With this Report is issued the financial statement for the year 1882, showing a balance in hand of £147 8s. 1d. At the first Council Meeting after the last Report, the balance stood at £120; and in accordance with Clause 1 of Law XI., half of that amount was deposited with the London and County Bank, in the names of the Treasurer, Mr. Jones, and the Secretary.

The Technical Classes have now been carried on in connexion with the City and Guilds of London Institute for two years and a-half. At the beginning the arrangements were necessarily of a tentative character. Considerable difficulty was experienced in dealing with demands for different kinds of practical teaching. Actual workshop instruction can be imparted to but comparatively few, on account of the necessity of providing ample bench-room in a good light for each student. Then a system of teaching for lads who, with no previous knowledge of the trade, desired to avail themselves of the Institute in order to become watchmakers, would not be adapted for others who are already grounded, but wish to perfect themselves as quickly as possible. It was also felt that the claims of young workmen practising as watch jobbers, who, while anxious to improve themselves in the chief branches of the trade, were yet unable to devote the day to class work, should not be passed over.

At first day classes alone were tried for practical work, with benches and other accommodation for twelve students. These classes are held on Mondays, Tuesdays, Thursdays, and Fridays, from ten o'clock till five, under the direction of Mr. H. Bickley and Mr. C. Curzon. All the benches are now occupied, the attendance is fairly regular, and, judging from the reports of the examiners, encouraging progress is made.

An evening class for escapement making was started in September, 1881, under Mr. Curzon, with very gratifying results. It is held on Mondays, Wednesdays, and Fridays, from seven till a quarter to ten, and is now full, the attendance being limited, as in the day classes, to twelve students.

The Institute is still indebted to Messrs. Barraud & Lunds for the receipt of hourly time-signals, and the winding of the synchronized clock presented by them.

At the suggestion of the Council, the City and Guilds' syllabus relating to watch and clock making has been revised, so that candidates may be examined in more technical and less abstract subjects.

Another step has been taken to render the course of technical instruction complete. The class for mechanical drawing, under Mr. Britten, which has been established for some years as a separate study, is thrown open to students attending the practical classes, and the hours rearranged to suit them as well as outsiders. It is now held on Tuesdays from half-past five till seven, and on Thursdays from eight till half-past nine.

With a view of encouraging a spirit of emulation, the Council propose that an examination of the students take place in June, and the Silver Medal of the Institute be awarded to the most efficient student in the three branches—Practical, Theoretical, and Drawing. An additional medal is offered to the most proficient student in the Drawing Class.

A form of certificate has been prepared, stating the proficiency attained by students. It will be issued as soon as the different standards have been decided on, and the arrangements for testing the knowledge of students perfected. A proposition to award the Silver Medal of the Institute in all cases where the student has reached the highest standard in all branches is also under consideration.

The period of three years during which the City and Guilds of London Institute agreed to subscribe £350 a year towards the funds of the Institute expires in April next, but the Council have received an intimation that the grant will be renewed for a further term of three years from that date.

The Silver Medal of the Turners' Company, offered to the producer of the best specimens of horological turning, executed by a person not over twenty-one years of age, was awarded to Alfred John Barnsdale, a student at the classes of the Institute, who had the exceptional honour of taking the Silver Medal of the Institute during the same year.

An American contemporary reports that a general reduction of the wages of the employés of watch and case factories is contemplated. The Illinois Watch Company, of Springfield, and one or two case factories, have already taken the initiative by reducing wages from ten to fifteen per cent.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(*Concluded from page* 86.)

In order to determine the mean quality of several ingots of various weights and reports in Milliemes, or to find the quantity of Standard Silver or of Fine Silver collectively in the aggregate ingots of Silver Bullion, proceed as follows:—

Weight of Ingots.		Report in Milli.		Product of Multiplication.
46 ozs.	×	·230 fine	=	10580
30 ,,	×	·570 ,,	=	17100
15 ,,	×	·925 ,,	=	13875
18 ,,	×	·850 ,,	=	15300
109 ozs.	..	divided into	..	)56855(·521.$_{6}$ fine.

Ans.—The fineness of 109 ozs. of above various reports is ·521·6 fine.

What quantity of Standard Silver of ·925 fine is in the above 109 ozs.?

Collective Fineness.
Divide by Standard of ·925)56855(61$\frac{430}{925}$oz. = 61ozs. 9dwts. 7$^{5}/_{37}$gr. stand.

Ans.—The collective quantity of Standard in the above 109 ozs. is 61 ozs. 9 dwts. 7$^{5}/_{37}$ grs. Standard of ·925 fine.

To find the collective quantity of any other Standard than ·925 fine, divide by the Milliemes of the respective Standards.

What quantity of Fine Silver is in the above 109 ozs. of various reports?

Collective Fineness.
Divide by unity of 1000)56855(56$\frac{855}{1000}$oz. = 56ozs. 17dwts. 2½grs. F. Silv.

Ans.—The collective quantity of Fine Silver in the above 109 ozs. of various reports is 56 ozs. 17 dwts. 2½ grs. Fine Silver.

Table for comparing the Fine Contents of Gold and Silver of the adopted Divisions and Standards in the principal countries.

A.—TABLE FOR GOLD WARES.

Great Britain. Division: Quantity of Fine Gold in oz., dwts., and grs. in the pound troy, or with reference to Coin Standard of 22 car., designated *Better* if above, and *Worse* if below the Standard. Standards for Gold Ware, 22 car., 20 car., 18 car., 15 car., 12 car., 9 car.

Germany and Austria. Division: In 24 car. and subdivision in 16ths of a car. Standards variable in the differ. States and Provinces 18, 17, 16, 14, 13½, 13, 12, 11, 8 and 6 carat.

Russia. Division: In 96 parts and subdivisions in vulgar fractions. Adopted Standards variable, but the principle ones in use are 84 = 21 carat, 72 = 18 carat, 56 = 14 carat.

France Belgium Holland, Italy Switzerland Spain, and U. States. Division: In Millieme. Standard in the European Countries, principally ·750 = 18 car. In U.S. 18, 16 14, 12, 8, and 6 carat.

Great Britain. In the lb. Oz.	Dwt.	Gr.		Carat.	Germany, &c. Carat.	Russia.	France, &c.
12	0	0	or Better	2	24	96–96	1·000
11	10	0	,,	1	23	92–96	·958$^{1}/_{3}$
11	0	0	Coin Stand.		22	88–96	·916$^{2}/_{3}$
10	10	0	or Worse	1	21	84–96	·875
10	0	0	,,	2	20	80–96	·833$^{1}/_{3}$
9	10	0	,,	3	19	76–96	·791$^{2}/_{3}$
9	0	0	,,	4	18	72–96	·750
8	10	0	,,	5	17	68–96	·708$^{1}/_{3}$
8	0	0	,,	6	16	64–96	·666$^{2}/_{3}$
7	10	0	,,	7	15	60–96	·625
7	0	0	,,	8	14	56–96	·583$^{1}/_{3}$
6	10	0	,,	9	13	52–96	·541$^{2}/_{3}$
6	0	0	,,	10	12	48–96	·500
5	10	0	,,	11	11	44–96	·458$^{1}/_{3}$
5	0	0	,,	12	10	40–96	·416$^{2}/_{3}$
4	10	0	,,	13	9	36–96	·375
4	0	0	,,	14	8	32–96	·333$^{1}/_{3}$
3	10	0	,,	15	7	28–96	·291$^{2}/_{3}$
3	0	0	,,	16	6	24–96	·250
2	10	0	,,	17	5	20–96	·208$^{1}/_{3}$
2	0	0	,,	18	4	16–96	·166$^{2}/_{3}$
1	10	0	,,	19	3	12–96	·125
1	0	0	,,	20	2	8–96	·083$^{1}/_{3}$
0	10	0	,,	21	1	4–96	·041$^{2}/_{3}$
0	9	9	,,	21$^{1}/_{16}$	$^{15}/_{16}$	3¾–96	·039
0	8	18	,,	21$^{2}/_{16}$	$^{14}/_{16}$	3½–96	·036$^{2}/_{3}$
0	8	3	,,	21$^{3}/_{16}$	$^{13}/_{16}$	3¼–96	·034
0	7	12	,,	21$^{4}/_{16}$	$^{12}/_{16}$	3–96	·031$^{1}/_{3}$
0	6	21	,,	21$^{5}/_{16}$	$^{11}/_{16}$	2¾–96	·028$^{2}/_{3}$
0	6	6	,,	21$^{6}/_{16}$	$^{10}/_{16}$	2½–96	·026
0	5	15	,,	21$^{7}/_{16}$	$^{9}/_{16}$	2¼–96	·023$^{1}/_{3}$
0	5	0	,,	21$^{8}/_{16}$	$^{8}/_{16}$	2–96	·020$^{2}/_{3}$
0	4	9	,,	21$^{9}/_{16}$	$^{7}/_{16}$	1¾–96	·018$^{1}/_{3}$
0	3	18	,,	21$^{10}/_{16}$	$^{6}/_{16}$	1½–96	·015$^{2}/_{3}$
0	3	3	,,	21$^{11}/_{16}$	$^{5}/_{16}$	1¼–96	.013
0	2	12	,,	21$^{12}/_{16}$	$^{4}/_{16}$	1–96	·010$^{1}/_{3}$
0	1	21	,,	21$^{13}/_{16}$	$^{3}/_{16}$	0¾–96	·008
0	1	6	,,	21$^{14}/_{16}$	$^{2}/_{16}$	0½–96	·005$^{1}/_{3}$
0	0	15	,,	21$^{15}/_{16}$	$^{1}/_{16}$	0¼–96	·002$^{2}/_{3}$
0	0	7½	,,	21$^{31}/_{32}$	$^{1}/_{32}$	0⅛–96	·001$^{1}/_{3}$

B.—TABLE FOR SILVER WARES.

Division: 12 oz. in the pound troy, 20 dwts. to the oz.; the smallest division is ½ dwt in 12 oz., or with regard to Coin Standard of 11 oz. 2 dwt. in the pound troy.
Standards—
11 oz. 10 dwt. New Stand.
11 ,, 2 ,, Ord. ,,

Division in 16, called Löthig, and subdivision in vulgar fractions. Standards variable but the principal one in use is 12 Löthig = 9 oz. in the pound.

Division in 96 and subdivision in vulgar fractions. The only legal Standard is 84-96 or 10 oz. 10 dwt. in the pound troy.

Division in Milliemes. The Standard in the European Countries is variable; in use are ·950 ·934 ·750. In the U. S. generally ·900 and ·925.

In the lb. Oz.	Dwt.		Oz.	Dwt.	Löthig.		
12	0	or Better	0	18	16	96–96	1·000
11	2	or Coin Stand.			14$^{12}/_{15}$	88$^{12}/_{15}$–96	·925
11	0	or Worse	0	2	14$^{10}/_{15}$	88–96	·916$^{2}/_{3}$
10	0	,,	1	2	13$^{5}/_{15}$	80–96	·833$^{1}/_{3}$
9	0	,,	2	2	12	72–96	·750
8	0	,,	3	2	10$^{10}/_{15}$	64–96	·666$^{2}/_{3}$
7	0	,,	4	2	9$^{5}/_{15}$	56–96	·583$^{1}/_{3}$
6	0	,,	5	2	8	48–96	·500
5	0	,,	6	2	6$^{10}/_{15}$	40–96	·416$^{2}/_{3}$
4	0	,,	7	2	5$^{5}/_{15}$	32–96	·333$^{1}/_{3}$
3	0	,,	8	2	4	24–96	·250
2	0	,,	9	2	2$^{10}/_{15}$	16–96	·166$^{2}/_{3}$
1	0	,,	10	2	1$^{5}/_{15}$	8–96	·083$^{1}/_{3}$
0	19	,,	10	3	1$^{4}/_{15}$	7$^{9}/_{15}$–96	·079$^{1}/_{6}$
0	18	,,	10	4	1$^{3}/_{15}$	7$^{3}/_{15}$–96	·075
0	17	,,	10	5	1$^{2}/_{15}$	6$^{12}/_{15}$–96	·070$^{5}/_{6}$
0	16	,,	10	6	1$^{1}/_{15}$	6$^{6}/_{15}$–96	·066$^{4}/_{6}$
0	15	,,	10	7	1	6–96	·062$^{3}/_{6}$
0	14	,,	10	8	$^{14}/_{15}$	5$^{9}/_{15}$–96	·058$^{2}/_{6}$
0	13	,,	10	9	$^{13}/_{15}$	5$^{3}/_{15}$–96	·054$^{1}/_{6}$
0	12	,,	10	10	$^{12}/_{15}$	4$^{12}/_{15}$–96	·050
0	11	,,	10	11	$^{11}/_{15}$	4$^{6}/_{15}$–96	·045$^{5}/_{6}$
0	10	,,	10	12	$^{10}/_{15}$	4–96	·041$^{4}/_{6}$
0	9	,,	10	13	$^{9}/_{15}$	3$^{9}/_{15}$–96	·037$^{3}/_{6}$
0	8	,,	10	14	$^{8}/_{15}$	3$^{3}/_{15}$–96	·033$^{2}/_{6}$
0	7	,,	10	15	$^{7}/_{15}$	2$^{2}/_{15}$–96	·029$^{1}/_{6}$
0	6	,,	10	16	$^{6}/_{15}$	2$^{6}/_{15}$–96	·025
0	5	,,	10	17	$^{5}/_{15}$	2–96	·020$^{5}/_{6}$
0	4	,,	10	18	$^{4}/_{15}$	1$^{9}/_{15}$–96	·016$^{4}/_{6}$
0	3	,,	10	19	$^{3}/_{15}$	1$^{3}/_{15}$–96	·012$^{3}/_{6}$
0	2	,,	11	0	$^{2}/_{15}$	0$^{12}/_{15}$–96	·008$^{2}/_{6}$
0	1	,,	11	1	$^{1}/_{15}$	0$^{6}/_{15}$–96	·004$^{1}/_{6}$
0	½	,,	11	1½	$^{1}/_{30}$	0$^{3}/_{15}$–96	·002

CHATWOOD'S "INVINCIBLE" SAFES

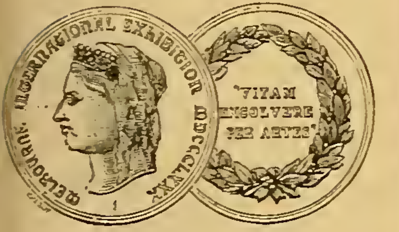
HIGHEST AWARDS ALL EXHIBITIONS

GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST. E.C.

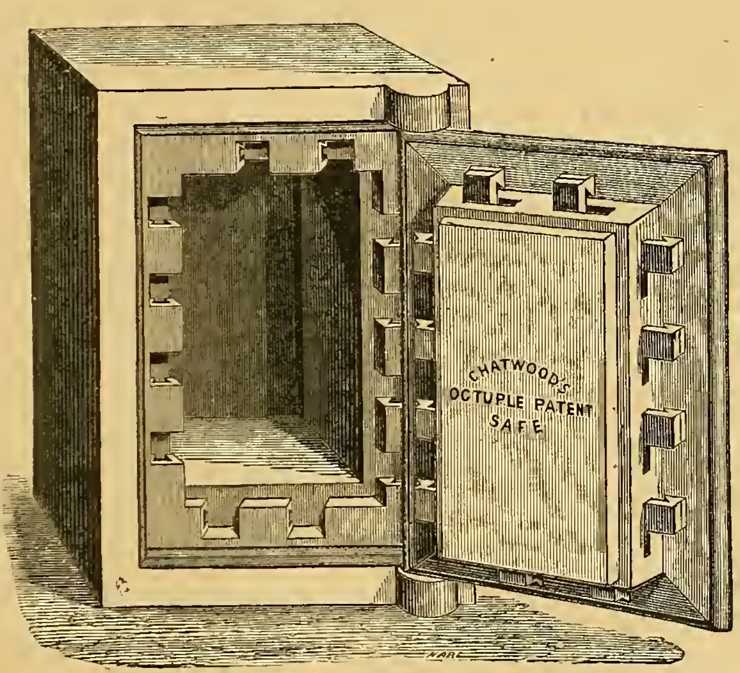
MELBOURNE
International
Exhibition.
1880-1.

SPECIAL
GOLD MEDAL


MELBOURNE INTERNATIONAL EXHIBITION
MDCCCLXXX
"VITAM EXCOLVERE PER ARTES"

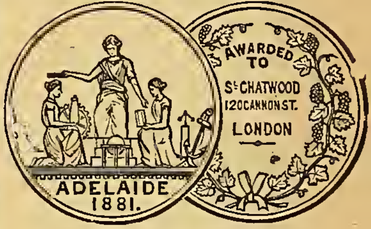
AND
THREE FIRST
ORDERS OF MERIT.

120,
CANNON STREET,
LONDON.
22, BOND STREET,
LEEDS.


CHATWOOD'S
OCTUPLE PATENT
SAFE

ADELAIDE
International
Exhibition.
1881.

SPECIAL
GOLD MEDAL


ADELAIDE
1881.
AWARDED TO
S. CHATWOOD
120 CANNON ST.
LONDON

AND
THREE FIRST
DEGREES OF MERIT.

11,
CROSS STREET
MANCHESTER.
WORKS: BOLTON.

CHATWOOD'S "INVINCIBLE" SAFES

HIGHEST AWARDS ALL EXHIBITIONS

GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST. E.C.

ENGLISH *v.* FOREIGN MANUFACTURE.

So much has been heard lately about the improvement in workmanship abroad and of its deterioration here, that it is gratifying to find an instance where England has fully maintained her old pre-eminence. The Dutch papers just to hand contain reports of the trial of an English safe, which was brought about somewhat strangely. It appears that some time since there was at Arnhem an international exhibition under the authority of the Government of the Netherlands. Among the objects intended to be tested, and for which medals and rewards were offered, were safes. The conditions of competition were prepared by authority, and they stated that a safe was wanted that should be at once fire-proof, fall-proof, and burglar-proof. A gold medal and a money prize was offered to the most successful maker, and a silver medal and a smaller money prize to the second. Mr. Samuel Chatwood, the well-known English safe manufacturer, determined to compete for the prize, and made a safe to answer the conditions imposed. It happened, however, that the Netherlands Minister of Commerce asked him to assist on the jury; he was elected president, and that made competition on his part impossible. There were twelve competitors; nine of them were Dutch and three German. The first hour's fire over, the fall test followed, and two of the safes were utterly broken, and so placed *hors de combat.* The remaining ten went through the second fire test, and it was afterwards found that in each the papers inside were charred. Two workmen, with a set of ordinary burglar forcing tools, undertook the burglar's task, and opened all the ten safes in twelve hours. No safe withstood their attack for four hours, while one was opened in less than five minutes. There were complaints, and several of the safe-makers and others interested said openly that the conditions of trial were such that no safe could stand. On this Dr. Bosscha, the president of the international grand jury, asked Mr. Chatwood if he would consent to his safe being submitted to the same tests. He consented, and the trials took place on the 20th of December at Amsterdam.

The announcement caused considerable excitement among the safe-makers on the Continent. M. Van der Maden, the Director of the royal factory for the making of steam and other engines, found the space on which the trials were to take place. On Saturday morning, the 20th December, a goodly number of people assembled, and before the firing test began there were present many of the principal inhabitants of Amsterdam, including members of the Government, of the Town Council, of the Army and Navy, as well as of merchants and manufacturers. Almost all the safe-makers who competed at Arnhem were there to see how this English safe would bear itself under the conditions which led to their easy defeat. Four brick pillars were built on a circular brick base, and on these the safe was placed, the hauling being done by a powerful crane resting on huge shears. The safe was 5ft. high, 2ft. 7½in. wide, and 2ft. 2½in. deep; it weighed 2 tons. As soon as it stood in its place, several men heaped about it plenty of wood in large and small pieces, and then started the fire. Before it had burned ten minutes, the fuel reached to and lay on the top of the safe, and so intense was the heat that the hundreds of people about were forced to keep their distance, and a small fire engine was called into requisition to play on the shears and save them from combustion. After burning an hour the safe was lifted to the height of twenty feet and pulled over a stone-laid floor for the second or fall trial. This trial was more severe than was intended, for before the men were ready the slip-hook was accidentally released, and the safe came down with a tremendous thud on the stones, breaking and sinking them into the hard frozen ground. No effect of any kind was produced on the safe, and it was again subjected to fire for three hours longer. Here again the test was more severe than at Arnhem, for while there only eight cubic yards of wood were used as fuel, at Amsterdam twelve cubic yards were burned. There was much speculation as to the condition of the safe, most of the safe-makers present being convinced that the fire test had been too much for it.

On the Monday morning the interest seemed to have increased, as there was again a large assembly of people to see the lifting of the safe and the placing of it in a shed to be submitted to the burglar-proof test. The jury had invited the competitors of Arnhem to select two of the most skilled workmen they knew to undertake this, but they all declined, notwithstanding the fact that Mr. Chatwood offered a reward of 100 gulden to the workmen who succeeded in opening the safe. Under these circumstances M. Van der Maden found two, one of them having been a safe-maker for twelve years. They were complimented all round on the skill they displayed in finding points of attack. They had brought their own tools with them, and were permitted to use them or those which were used at Arnhem. They elected to use the latter set, weighing 56 lb. They set to work, but after two hours' hard labour gave up, saying they had broken all their chisels and bars. Mr. Chatwood then consented that they should use also the tools they themselves had brought, another weight of 56 lb. They set to again, but were just as much foiled. All the time they were at work some of the safe-makers stood close by, and were continually making suggestions.

This failure being complete, Mr. Chatwood resolved to try to open the safe, so as to get at the contents, by machinery next day. At five minutes to ten the next morning, after drawing the safe to its place under a powerful radial steam drilling machine, the men commenced to drill out the stud bolts of the door, under Mr. Chatwood's superintendence. The working drawings not being at hand, the exact position of these studs could not be told, which necessitated the drilling of three holes for one stud and two holes for another in the bottom of the door. During the time this drilling was going on the machine was running at its highest power. After this, at Mr. Chatwood's request, an attempt was made to drill out the lock. The attempt proved futile on account of the point of the drill coming into contact with the hard metal intersection between the lock and the outer door. After placing considerable power on the drill it was withdrawn. The point of the drill was found completely rounded off in the attempt to get through the hard metal. After all the studs were drilled out, and therefore the actual holding power of the door was gone, an attempt was made to prise open the outer door by means of sets and heavy sledges. This, however, proved completely unsuccessful. The safe was then turned on the side on which the hinges were, and two large holes drilled on this side by the radial drill. After this, by means of large steel drifts and a further application of the crowbars, the door was at length opened. This was not until about four o'clock, and many men had been employed. A change of hands for the hammers was employed throughout, about ten of the best men in the works being told off for the duty. The interior door was opened by its own keys after a delay of about twenty minutes, the delay being occasioned by the bolts having become rusted into their holes by the condensation of steam during the fire proof. On the door being opened the papers were found in every respect in as good condition as when put in the safe before the fire test.

The trials were under the special direction of Dr. J. Bosscha, Director of the Polytechnic School of Delft; Ph. Lindo, Director of the Cement Factory, Delft; H. A. Raveneck and J. G. Snijders, Professors of the Polytechnic School, Delft; H. L. Woltersom, Civil Engineer, Arnhem—these being the president, secretary, and members of the jury for the international concours held at Arnhem. These gentlemen have signed and issued an official report, in which they state that the safe stood each test perfectly; that all the documents in the safe were uninjured, writing and printing being exactly as when placed inside; and they further say—"On the strength of these trials, the undersigned judge that the requisites demanded in the Arnhem programme and tests for a safe constructed on proper principles have proved by no means too severe for the safe of Mr. Chatwood; nay, that in all probability Mr. Chatwood's safe would have stood a severer test for fire, falling, and burglary."—From the *Morning Post,* January 10, 1880.

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 91.)

AFTER passing through a golden age of mediæval excellence, unequalled by anything since the most perfect period of Greek art, this wonderful style (an admirable material expression of Christian thought and sentiment) degenerated into affected mannerism. Beautiful ironwork was executed, but little of the bronze sculpture which in larger works was rare as compared to that in stone and wood, remains. The shrine of S. Taurinus, in the Cathedral of Evreux, is an example of metalwork of the thirteenth century; and various reliquaries and church vessels, &c., in silver and gilded copper still survive to prove the excellence of the goldsmith's skill at that period. The tombs of Everard de Foiulloy (died 1222) and Geoffrey d'Eu (died 1236), Bishops of Amiens, in that Cathedral, are splendid works. Each figure is cast in high relief upon a slab, which is supported at the angles and sides by six lions; a gracefully-decorated niche is above the head, and small figures of angels holding censers are at the sides. These works appear to have been cast, and differ materially from the manner of those worked by the artists of Limoges, who adhered to the method of affixing beaten plates upon a wooden core.

Perhaps the latest of the Limoges tombs still preserved to France is that in the Louvre—the recumbent effigy of Blanche de Champagne (1283), wife of John I., Duke of Brittany. It is of beaten and gilt copper plates upon an oaken core, the pillow, &c., enamelled; the head is *repoussé*. The tomb of Walter de Merton, Bishop of Rochester (1277), was by "Johannes Limovicensis." The tomb of William de Valence in Westminster Abbey is also supposed to be by a French worker of this century (1296).

At that period a strong artistic feeling prevailed among all classes, and was exhibited on secular vessels as much as on the objects for church use. Grotesque figures of animals and imaginary creatures were contorted into the form, or decorated the spouts and handles of jugs and drinking vessels. Especially beautiful was the sculpture in ivory, a material in which that art may be traced and studied almost in unbroken series from a very remote date. The brilliant artistic period of the thirteenth and early fourteenth century in France was succeeded by one of war and internal trouble. Works were not only less numerous, but of less excellence, and sculpture in so valuable a material as bronze was comparatively rare. The purer Christian art had faded away, and an interval of small activity was replaced by the current of the revival which, encouraged by Charles VIII., Louis XIII., and their Courts, flowed in from Italy. The influence of Flemish taste continued to hold its sway during the fifteenth century, but there were only few examples of larger undertakings in solid metal. Out of the enormous wealth in precious and artistic objects, which once so richly adorned the great churches and conventual establishments of France, very little remains, the iconoclastic spirit of religious reformers and the greed of political revolutionists having encouraged spoliation of what war had spared.

Admirable as had been the development of French sculpture in stone and in ivory during the thirteenth and earlier years of the fourteenth centuries, her native artists were but weak during the fifteenth; Flemish influence continued its power, mingling with the stream of Italian *renaissance*. The new style became fully established through the encouragement given to Italian artists by Francis I. in the course of the sixteenth century. Sculpture, moreover, was not so abundant in the fifteenth century as it had been previously, and works in bronze were few. Excellent woodwork was produced, as choir-stalls, &c., and monumental sculpture was chiefly in marble. In the following century the influence of Cellini upon Jean Goujon, the leading French sculptor of that period, is distinctly shown in the marble group of "Diana with the Stag," by the latter artist, which is preserved in the Louvre; Germain Pilon, on the other hand, was a follower of Primaticcio's manner.

We must, however, confine ourselves to bronzes; yet not all of these are by native sculptors, although the admirable castings executed by French founders under the supervision of Primaticcio are worthy of all praise. By Germain Pilon are a bronze *relievo* representing the dead Saviour mourned by His disciples, and a kneeling figure of René Biraque, both in the Louvre. Barthélemy Prieur executed the fine bronze figures of Peace, Abundance, and Justice, now in the same museum, which once formed part of the tomb of the Montmorency.

From this period we find that France takes an important place in the production of artistic works in bronze, but the influence of the Italian school continues to be felt, although modified by a French manner; and we must, through want of space, again refer the reader to the introduction to the large catalogue for a detailed notice of the chief French bronzists since 1600, and of their works. We would, nevertheless, not omit to notice that we owe our finest equestrian statue, the Charles I., at Charing Cross, to Hubert le Sœur, a Huguenot refugee, who died in England in 1652.

We regret that the South Kensington Museum is not richer in the admirable ornamental bronze work, both gilded and dark, which was produced in France so abundantly during the reigns of Louis XIV., XV., and XVI. We allude particularly to the clock-cases, furniture mountings, candelabra and candlesticks, mountings to vases of marble, &c., of which so large and so choice a selection is possessed by Sir Richard Wallace, and lately liberally exhibited at Bethnal Green. The Royal collection at Windsor is very rich in similar furniture bronzes, and in groups and statuettes of bronze, both Italian and French. In the Louvre are some fine examples removed from St. Cloud and other Royal residences. The excellent modelling and the perfected technical manipulation of many of these works, render them examples for the study of the practical bronzist. Good indeed, also, are some copies of these productions, the work of able French medallists of our own day, and few, if any, superior to those executed in London by Mr. Hatfield, whose ability as a caster and chaser has descended to his nephew. Many of these works have since passed for original, although far from the intention of those by whom and for whom they were made. The Barker collection, lately dispersed, contained excellent examples of these modern copies, the work, for the most part, of a French hand now no more. Among those who produced the originals may be mentioned André Charles Boule, or Boulle (1642-1732), and his pupil, Philippe Caffieri, a "*fondeur et ciseleur*," the metal-work on whose cabinets is as important as the inlaying. The gilt bronze work of Martincourt and of Gouthière (born 1740), his admirable pupil, was never surpassed. Gouthière's name but rarely occurs on his works; one fine example, a clock-case, is in Sir R. Wallace's collection, signed "*Gouthière, Ciseleur et Doureur du Roi, à Paris, Quai Pélletier, à la Boucle d'or*, 1771." His work sometimes occurs in connection with models by Clodion, &c., and with furniture by David Riesener, executed for Louis XVI. and his Court.

(*To be continued.*)

John Harrison, the Chronometer Maker.

(*Continued from page* 85.)

THE preamble of the Act of Parliament in question runs as follows: "Whereas it is well known by all that are acquainted with the art of navigation, that nothing is so much wanted and desired at sea as the discovery of the longitude, for the safety and quickness of voyages, the preservation of ships and the lives of men," and so on. The Act proceeds to constitute certain persons commissioners for the discovery of the longitude, with power to receive and experiment upon proposals for that purpose, and to grant sums of money not exeeding £2,000 to aid in such experiments. The clause of the Act, by which rewards are offered to such inventors or discoverers as shall succeed in enabling the longitude to be ascertained within certain limits, is as follows:—

"And for a due and sufficient encouragement to any such person or persons as shall discover a proper method for finding the said longitude, be it enacted by the authority aforesaid that the first author or authors, discoverer or discoverers, of any such method, his or their executors, administrators, or assigns shall be entitled to, and shall have such reward as is hereinafter mentioned; that is to say, to a reward or sum of £10,000 if it determines the said longitude to one degree of a great circle, or sixty geographical miles; to £15,000 if it determines the same to two-thirds of that distance; and to £20,000 if it determines the same to one-half of the same distance; and that one moiety or half part of such reward or sum shall be due and paid when the said commissioners, or the major part of them, do agree that any such method extends to the security of ships within eighty geographical miles of the shores which are the places of the greatest danger, and the other moiety or half part when a ship, by the appointment of the said commissioners, or the major part of them, shall thereby actually sail over the ocean from Great Britain to any such port in the West Indies as these commissioners, or the major part of them, shall choose or nominate for the experiment, without losing their longitude beyond the limits before mentioned."

It will, in these days, be scarcely believed that little more than a hundred years ago a prize of not less than ten thousand pounds should have been offered for a method of determining the longitude within *sixty miles*, and that double the amount should have been offered for a method of determining it within *thirty miles!* The amount of these rewards is sufficient proof of the fearful necessity for improvement which then existed in the methods of navigation. And yet, from the date of the passing of the Act in 1714 until the year 1736, when Harrison finished his first timepiece, nothing had been done towards ascertaining the longitude more accurately, even within the wide limits specified by the Act of Parliament. Although several schemes had been projected, none of them had proved successful, and the offered rewards, therefore, still remained unclaimed.

To return to Harrison. After reaching his home at Barrow, after his visit to London in 1728, he began his experiments for the construction of a marine chronometer. The task was one of no small difficulty; it was necessary to provide against irregularities arising from the motion of a ship at sea, and to obviate the effect of alternations of temperature in the machine itself, as well as in the oil with which it was lubricated. A thousand obstacles presented themselves, but they were not enough to deter Harrison from grappling with the work he had set himself to perform.

Everyone knows the beautiful machinery of a timepiece, and the perfect tools required to produce such a machine. Some of these Harrison procured in London, but the greater number he produced for himself. Many entirely new adaptations were required for his chronometer. Wood could no longer be employed, and he had therefore to teach himself to work accurately and minutely in brass and other metals. Having been unable to obtain any assistance from the Board of Longitude, he was under the necessity, while carrying forward his experiments, of maintaining himself by working at his trade of a carpenter and joiner. This will account for the very long period that elapsed before he could bring his chronometer to such a state that it might be tried with any approach to certainty in its operations.

Harrison, besides his intentness and earnestness in respect of the great work of his life, was a cheerful and hopeful man. He had a fine taste for music, and organised and led the choir of the village church, which attained a high degree of perfection. He invented a curious monochord, which was not less accurate than his clocks in the mensuration of time. His ear was distressed by the ringing of bells out of tune, and he set himself to remedy them. At the parish church of Hull, for instance, the bells were harsh and disagreeable, and by the authority of the vicar and churchwardens he was allowed to put them into a state of exact tune, so that they proved entirely melodious.

But the great work of his life was his marine chronometer. He found it necessary, in the first place, to alter the first mover of his clock to a spring wound up, so that the regularity of the motion might be derived from the vibration of balances, instead of those of a pendulum in a standing clock. Mr. Folkes, President of the Royal Society, when presenting the gold medal to Mr. Harrison in 1749, thus describes the arrangement of his new machine. The details were obtained from Harrison himself, who was present. He made use of two balances situated in the same plane, but vibrating in contrary directions, so that the one of these being either way assisted by the tossing of the ship, the other might constantly be just so much impeded by it at the same time. As the equality of the times of the vibrations of the balance of a pocket-watch is in a great measure owing to the spiral spring that lies under it, so the same was here performed by the like elasticity of four cylindrical springs or worms applied near the upper and lower extremities of the two balances above described.

(*To be Continued.*)

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Taxation of Gold and Silver Plate.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER AND SILVERSMITH."

Sir,—Watchmakers, although their productions are exempt from any demands on the part of the excise officer, should recollect that they are interested in the question of the duties upon gold and silver plate to the extent that no reform of the hall-marking laws is in the least degree probable, so long as those duties are allowed to prevail, inasmuch as it cannot be denied that the system of compulsion is a protection to the revenue, and as such it will be regarded by the Government. It therefore follows that if watchmakers desire a reform in the interests of their craft, they would act wisely by memorializing the Chancellor of the Exchequer and the President of the Board of Trade, in favour of paving the way for a Hall-marking Reform Bill, by the immediate abolition of the duties.

I am, Sir, yours obediently,

Pall Mall East, EDWARD J. WATHERSTON.

Feb. 1st, 1883.

A Cheap English Chronograph.

PROPOSED NEW COMPANY.

IN the 11th ult., a meeting of gentlemen interested in the promotion of a Limited Liability Company to acquire and work certain British and foreign patents, granted to Mr. W. H. Douglas, of Stourbridge, for "Improvements in Chronographs," was held at the Midland Hotel, Birmingham. Amongst those present were Messrs. Aaron Blanckensee, J. Neale, Reuben Plant, J. W. Lewis, W. O. Lewis, T. Burley, W. H. Griffiths, C. Osborne, J. B. Cameron, W. W. Clulee, C. H. Lewis, E. C. Weller, W. H. Douglas (the patentee), and Mr. G. T. Sheridan Plant, solicitor.

Mr. Douglas has invented and patented a double chronograph, which for simplicity and accuracy is superior to the very expensive chronograph now in the market, and by his process he is able to make them at very little extra cost over the price of an ordinary keyless lever watch. The basis of the instrument is the ordinary English keyless lever, on the top plate of which a few parts are added, transforming the instrument into a perfect double chronograph, with double fly back. These parts are all machine-made, interchangeable, and do not require to be adapted by specially skilled workmen. They can be adapted to the cheapest watches as well as the most expensive, thus bringing them within the range of all classes. By pressing the winder downwards the centre finger, which registers seconds and fifths, is started; by again pressing it, it is stopped, and a similar pressure returns it to zero, ready to start again. This centre finger makes a revolution in exactly one minute, and the minutes are registered, as they pass, on the top dial. This small minute finger is returned to zero by the same pressure which returns the centre finger. Times can thus be taken in minutes, seconds, and fifths, at one glance, and without trouble or calculation. The patentee has received large orders, but a large capital being required to work the patent, it is intended to do so by means of a limited liability company, and several well-known manufacturing jewellers and others have signed the articles of association. For the sum of £15,000 the patentee assigns to the company his various patents, 20,000 chronograph parts, and 300 watch movements or thereabouts. He takes £10,000 of such purchase-money in fully paid-up shares, and has engaged to devote himself to the interests of the company as manager, and not to receive any salary for his services until after such dividends have been paid as amount in the aggregate to 19 per cent. upon the capital subscribed. The capital of the company will be £50,000, divided into 5,000 shares of £10 each. It is not intended to expend the capital in laying down expensive machinery, but in the purchase of movements, cases, &c., to which the chronograph parts (more than 20,000 of which are assigned to the company) will be fitted, and double chronographs produced in various qualities under the personal supervision of the patentee.

Mr. Plant, in explaining the object of the meeting, said that in the first place this patent was not the result of fortuitous circumstances, nor of a happy accident, as some inventions were, but was deliberately worked out by Mr. Douglas, from a suggestion by one of the largest watch manufacturers in Switzerland. Mr. Douglas was a practical watchmaker, and he found in the course of his trade that he had many applications for chronographs. Those watches being very expensive, he thought that if he could supply a good one at a reasonable rate, he should be able to do a good trade in them. That turned his attention to inventing a chronograph, and he invented one which he considered as perfect as could be made. It registered the seconds and fractions of a second on the front dial, but it registered the minutes at the back. He took it to a large firm in London, who introduced him to one of the leading and richest watch manufacturing firms in Switzerland. He went over to Switzerland, and showed them his invention. They were very pleased with it, and made overtures to him to purchase it. He ascertained from them that they were manufacturing single chronographs in large quantities to the extent of 1,300 a-week, and that forced on his mind the fact that there would be an enormous and unlimited trade for a double chronograph. In discussing the matter, the Swiss manufacturer said it was a very fine invention, but that if one was invented registering the minutes also on the front dial, it would sweep all others out of the market. He did not sell that invention, but came back, and set himself steadfastly to work to invent such a chronograph as that suggested; and after nine or ten months' severe labour he succeeded in inventing the one now before the public, and obtained patents for it in Italy, Belgium, France, the Cape of Good Hope, Austria, Spain, India, and Canada; and he had applied for a patent for the United States. Having got the patents, he had to find out what to do with them. One merchant to whom he showed them immediately offered to take a gross. Not having the means at hand to supply them in quantities, and it occurring to him that it was a thing to invest very large capital in, he thought of a limited liability company, and his friends believed that there were plenty of capitalists in Birmingham and the neighbourhood who would only be too glad to support an invention which would place England at the head of the chronograph trade of the world. England had not gone a-head as Switzerland and the United States had in the manufacture of watches; but whatever came of the English watch trade, he was sure the English chronograph trade could not but take a primary position in the world if the capital was forthcoming to carry out this invention to a proper extent. He (Mr. Plant) had shown the chronographs to practical watchmakers and merchants, and found them spoken of universally in high terms of praise. The price at which they could be supplied would sweep all others out of the market, and realise a handsome profit; and they could be supplied in gold and silver at little more cost than ordinary keyless lever watches. Mr. Bishop, of London, had said that it was the finest thing he had seen. He had, he said, been a manufacturer of watches for fifty years, and had done all he could to uphold the English watch trade, but he found it was not progressing in proportion to the trade on the Continent or in the United States. If, however, this invention was taken up with spirit, and with sufficient capital, the supremacy of England would, at all events, be established throughout the length and breadth of the world as far as the chronograph trade was concerned. In conclusion, Mr. Plant said that the first prize in horology was awarded to Mr. W. H. Douglas for this double chronograph, at the Brighton Scientific Exhibition in December, 1881, and the Mayor of Brighton gave £50 for the chronograph that was exhibited.

After some discussion, during which the highest approval of the invention was expressed by Mr. W. O. Lewis and others, it was unanimously resolved that Messrs. Aaron Blanckensee, Alfred Lovekin, John Randle, and the patentee should be requested to act as directors.

Mr. Blanckensee stated that he had fully considered the matter, and had every confidence in the success of the undertaking, and would accept the position.

Mr. Lovekin and Mr. Randle were also understood to consent to act. Several of the chronographs were produced and handed round for the inspection of the meeting.

The proceedings then terminated.

Trade Notes.

A Concert in aid of the funds of the Watch and Clock Makers' Pension Society, of which Mr. J. U. Poole is the Treasurer, will take place at Foresters' Hall, Clerkenwell Road, on Tuesday evening, Feb. 27th. Tickets, 1s., 2s., and 3s. each. To commence at 8.

On Wednesday evening, the 24th ult., the first annual dinner of the London Chamber of Commerce was held at Cannon Street Hotel, and was largely attended by a very distinguished company, including Members of Parliament, Foreign representatives, and prominent citizens, the Right Hon. the Lord Mayor presiding, supported by Mr. Alderman and Sheriff DeKeyser and Mr. Sheriff Savory. The watch trade was represented by J. Tripplin, Esq., representative of the Besançon Chamber of Commerce.

Mr. G. Edward (Messrs. George Edward & Sons, Poultry), has had the honour of submitting for the inspection of the Prince of Wales, at Marlborough House, the gold casket which is about to be presented to General Lord Wolseley by the Lord Mayor and the Corporation.

Messrs. Radges & Co., of Hatton Garden and Coventry, have brought under our notice a new line of watch, which they have found to meet with considerable favour from shippers and factors as well as the general trade. It is a 14-size three-quarter plate going barrel lever, winding to the left, sprung over, and has a gold balance; it is jewelled in "three pair." There is, also, Jacquet's maintaining reversible mainspring, with pivotting brace. We have been given to understand that the makers are very well satisfied both with the work of the watch, and the patronage that it is receiving.

We have recently examined, at Mr. Samper's, 1, Holborn Circus, in conjunction with several horological brethren, a new clock that goes more than a year (400 days). Its construction is remarkably simple; there is not more work in it than in an ordinary eight-day French movement. The great economy of power is obtained by the slow motion of a torsion pendulum which vibrates forwards and backwards in fifteen seconds. Impulse is given at each vibration of the pendulum by a lever escapement, presenting, we think, some new features of construction that are highly commendable. The design and execution of the clock is far from satisfactory, and contrasts very unfavourably with the gems of artistic beauty by which it is surrounded, of which the proprietor of this establishment is evidently a connoisseur; nevertheless, it is well worth inspection, and we are so favourably impressed with it, that we hesitate not to say we see in it, in a crude state, the cheap house clock of the future.

The Patent (Metal) Die Company, Limited, has been formed for making expeditiously and cheaply dies in steel, for jewellers, silversmiths, art metal workers, &c.—in short, for all trades where dies are used for producing ornaments or stampings in metal; also for dies used in hot forgings. Owing to the great expense and delay attaching to steel dies made by hand, the trade is in many instances driven to use cast-iron dies; this method is imperfect, the work having to be chased after the stamping has been done, involving much loss of time and expense. The Company, by their patent process, produce steel dies from any given pattern, quickly and at less cost than by any previous method. They have erected suitable and extensive machinery at their works, 29, Addington Street, York Road, Lambeth, S.E. The City Offices are at 15, Walbrook, E.C.

A Correspondent writes to the *Pawnbrokers' Gazette*, that some persons who have recently discovered a process for clarifying (temporarily we presume) diamonds of a bad colour, have started on an expedition for defrauding the trade. He also states that they are able to colour them as well, and recommends washing these latter in hot spirits, which will remove the colouring.

Mrs. French, watch and clockmaker, Dowgate Hill, brought a claim for compensation against the joint committee of the Metropolitan and District Railway Companies, who have acquired her premises under their compulsory powers, for the purposes of the completion of the Inner Circle Railway. Mr. Lumley Smith, Q.C., with Mr. J. B. Firth, M.P., appeared for the plaintiff, and Mr. Bidder, Q.C., with Mr. McLeod, represented the defendants. Mrs. French had, since her husband's death, carried on the business which he had established at the Royal Exchange. Subsequently she removed to Dowgate Hill, the rent and taxes amounting to £400. She had fifteen and a-half years of her lease to run when the defendant Companies gave her notice that they required the premises; and after a great deal of difficulty she found a new place at the corner of Lawrence Lane, Cheapside, at a higher rental, viz., £550. The premises were not nearly so suitable as her old ones in Dowgate Hill. There was no workshop attached to them, which was the case at Dowgate Hill, and it was estimated that she would have to pay another £100 a-year for the accommodation, and the wages of a porter to take the work backwards and forwards. In addition to this, there were other drawbacks to the premises. There were twenty-one watchmakers in Cheapside, amongst whom was Sir John Bennett, whose well-known establishment was immediately opposite to the plaintiff's new shop, and great crowds of people were in the habit of congregating outside her windows to see Sir John's giants striking the chimes and hours. The claim was set down at £6,600. Mr. Lund, optician and chronometer maker, Cornhill, who was called on behalf of the claimant, said the class of trade done in Cheapside was totally different to that carried on in neighbourhoods like Cornhill and Cannon Street. He was aware that Sir John Bennett sold expensive watches, even as high as 120 to 150 guineas each; but these were not very extraordinary prices. It was not at all an uncommon thing for high-class watchmakers to charge from 1,000 to 2,000 guineas for watches that were specially made for certain climates. The Recorder: I should think they must be jewelled in every hole, and have a great many holes. (Laughter.) The case was ultimately adjourned to February 5.

Index to Antique Rings and Ornaments.

73—Copy of a curious magical ring found on the coast of Glamorganshire, near to "The Worm's Head;" much bent and defaced, and inscribed with mystic words inside and outside the hoop.

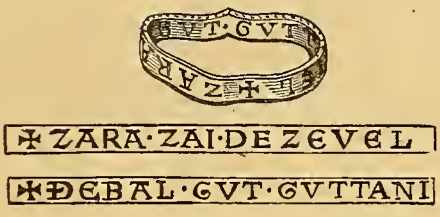
74—A very early ring, in the collection of J. Evans, Esq., F.S.A. It is of gold, set with a small sapphire, bearing a French inscription, the translation being, "I am here in place of a friend."

75—A wedding ring used on the occasion of the marriage of the celebrated Martin Luther to Catherine Boren. It is of elaborate design and execution, the engraving representing emblems of our Saviour's passion, the pillar, scourge, &c., with a representation of the crucifixion.

76—These rings were made probably about the beginning of the fourteenth century, both bearing Latin inscriptions.

77—A curious Hebrew ring in the Londesbourg collection, the workmanship of which is dated to the commencement of the sixteenth century.

ANTIQUE RINGS & ORNAMENTS.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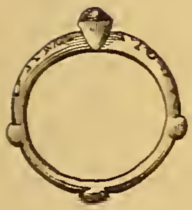

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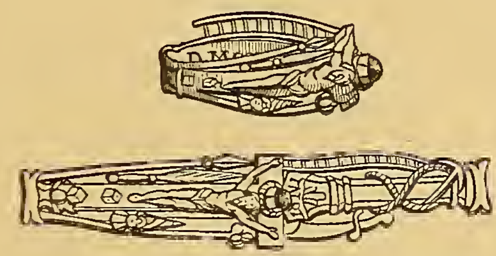

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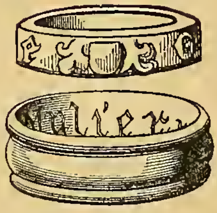

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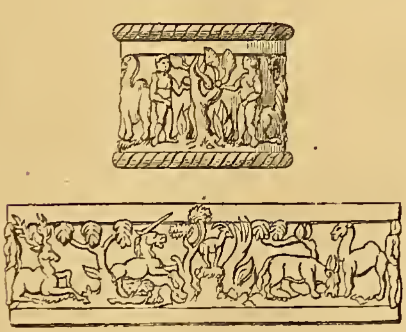

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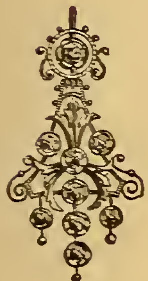
For Description, see page 104.

Supplement to the Watchmaker, Jeweller, and Silversmith, March 5th, 1883.

MONTHLY SUPPLEMENT OF DESIGNS.



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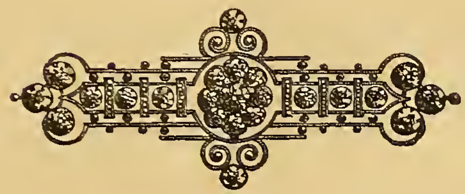

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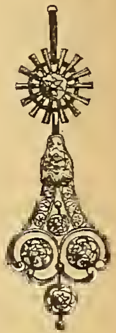

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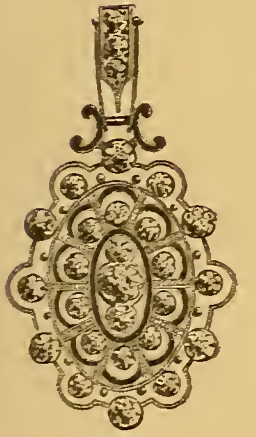

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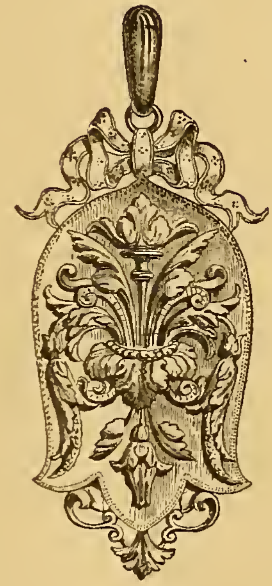

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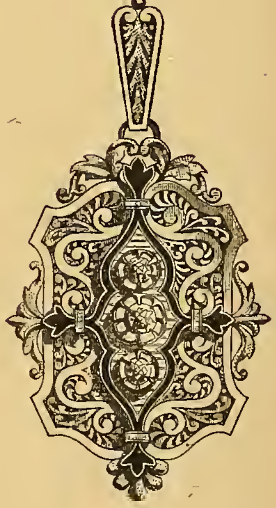

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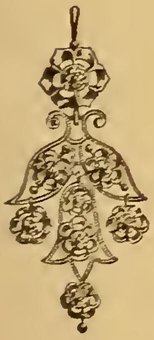

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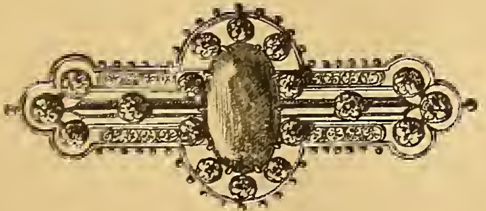

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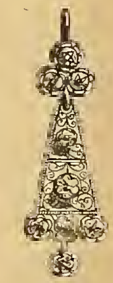

135.

THE WATCHMAKER JEWELLER AND SILVERSMITH

EDITED BY JAMES U. POOLE.

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ILLUSTRATED SUPPLEMENT:—Designs for Modern Jewellery.

Editorial.

Two months' since, the announcement immediately preceding this article would have occasioned as much surprise to "ourselves" as it doubtless does now to the majority of the readers of this journal, and we feel it is only appropriate, before definitely assuming editorial dignity, to make a few personal explanations, and also to give some indications of the policy which will be adopted by us in the future.

In the first place, we *like* the work; the habit of contributing to these columns has become a second nature to us, and as we have been assured that readers appreciate our efforts, we are proud of the new distinction.

Dr. Siemens, in replying to a letter we recently addressed to him on the subject of Technical Education, says, that "love of an occupation is essential to the attainment of efficiency." We have fully proved the truth of this in our own business, and consider that we start from a good basis.

Secondly, we have been greatly influenced in our decision to accept the responsibilities necessarily associated with the position, by the uniformly courteous and friendly treatment which, in our capacity of a contributor, we have received from the proprietor, Mr. A. Fischer, and anticipate much pleasure in entering into a closer connection with him.

Union is strength; and fortified by the existence of *l'entente cordiale*, we intend that the *Watchmaker, Jeweller, and Silversmith* shall not recede from the position it now occupies in the fore front of horological literature.

No pains will be spared to obtain the best and most reliable information on all matters of trade interest, and a free interchange of opinions among correspondents is invited as heretofore. Our editorial contributions will not be expected to pass unnoticed, and we will do our best to hold our own against all comers.

The progress of technical education, in connection with the allied industries, will be duly recorded and supported by us; we hope to have the pleasure of intercourse with, and receiving communications from, many young students; whatever practical knowledge we possess will be at their service, through the medium of our columns.

We shall at all times be ready to examine and impartially report upon specialities forwarded to us by manufacturers; but to use an American expression, our friends must be careful as to what they "send along," for we do not intend this Journal to degenerate into a mere puffing medium.

This article would be incomplete without a distinct reference to the Silver Trade, concerning which our indefatigable friend Mr. E. J. Watherstou wrote last month. The tax which he is so anxious to see removed (as a preliminary for abolishing compulsory Hall Marking) has been styled by him a "War Tax"; and in face of the recent expensive expedition in which our forces have been engaged, it seems highly improbable that it will be removed this Session, complicated as the question is by the undoubted right of those who have advanced money to the National Exchequer, by the payment of the duty to receive it again, in the form of a drawback.

Under these circumstances, it seems of questionable advantage at the present time to continue the agitation for absolute freedom, so, while admitting the topic for discussion, we intend to give our own attention to matters which we think will prove of more practical interest to the bulk of our readers.

In conclusion, we feel confident that all our friends will encourage us in our new capacity as Editor, by assisting to still further increase the circulation of the JOURNAL with which our name will henceforth be associated. Nothing succeeds like success, and we mean to get on.

The Swiss Watch Trade on the Continent in 1882.

Extracts from the reports of the Swiss Consuls.

BUCHAREST, 16th Dec., 1882.

DURING the year 1881, the direct importation of watches of all kinds from Switzerland to Roumania is raised to the sum of 500,000 francs in round figures. However, all the Swiss exporters have not had reason to congratulate themselves on the business done, for more than one watchmaker established here has closed his premises by reason of insolvency.

We know enough to recommend Swiss manufacturers not to part with their goods without having a confidential agent in the country.

GALATZ, 16th Dec., 1882.

Watches and jewellery find here a good demand. The best class of trade is in direct connection with Geneva, Chaux-de-Fonds, Locle, Bienne, &c. In gold watches, keyless hunters are almost exclusively asked for; those of the first quality are obtained from Geneva, and the medium and cheaper grades from the Chaux-de-Fonds.

Silver watches, for the most part keyless hunters, are obtained from Locle. First quality nickel, keyless open-face, like those which are obtained from Chaux-de-Fonds, sell but little. For the cheapest watches we prefer those of Bienne. Tools and watch materials are drawn principally from Chaux-de-Fonds; some, however, come from France. Musical boxes, playing from two to twelve airs, come from Geneva and Sainte-Croix.

Geneva supplies 18-carat jewellery, principally bracelets; while other articles, such as brooches, earrings, and charms, come for the most part from Hanau (Germany).

MESSINA, 18th Dec., 1882.

The watch business seems to be, if not extended, at least maintained; and the great extension of general prosperity assures us that for a long time yet watches will be in good demand.

The parcel post system, in use for a year, must greatly facilitate the exchange of the products of this industry. The watches which just now are selling exclusively, are those from the mountains of Jura and Neufchatel. It is a fact to remark, that more importance seems to be attached to their external beauty, than to the quality of the movements.

As for silver watches, the productions of an establishment on the borders of the lake of Zurich have some success. It appears that they are distinguished by good taste and low prices.

AMSTERDAM, 22nd Dec., 1882.

The trade in Swiss watches has not increased this year; the principal cause is in the fact that the quality of the watches most enquired for is constantly differing. Besides, the wholesale dealers do not find it profitable to keep Swiss watches, because manufacturers and commission agents come themselves to Holland and sell to the retailers by small quantities, even to a quarter of a dozen. Furthermore, many "gold" and "silver" watches are imported, the metal of which the cases are composed being very inferior. This greatly injures the medium grades of watches of good construction. Better quality watches have much to contend with against the American competition. Some time ago the Swiss watch withstood the competition by the elegance of the make of the case, which is much more elegant than the ugly American case. This advantage has been lost since the Swiss themselves make cases for Waltham movements, now selling in this place.

If the Swiss manufacturers desire to successfully maintain their ground, they must hold to the medium qualities, and not make any more of the inferior grades. That which concerns them most is the American watches. We can affirm that proportionally no other country in Europe has imported more of them than Holland; it is, however, not impossible—and this I state with pleasure—that in spite of the American advertisements, the Swiss watch may again be appreciated and even preferred. In effect, when the quality is compared with that of the American watch, the difference of price is in favour of the former.

(To be Continued.)

Waltham Watches in Australia.

EVER since the Sydney and Melbourne Exhibitions, the American Watch Company has been doing a good trade with the Australian Colonies, and it has now attained such large proportions as to necessitate the opening of a branch establishment at Melbourne. The Melbourne branch will no doubt be carried on with the same energy and spirit which so rapidly developed the business in this country; in fact, as far as we are concerned, we feel quite sure of it, as the manager selected for the new establishment is Mr. D. Mauson, who so ably represented the Company at the Australian Exhibitions.

While on the subject of Waltham watches, we may mention that we have seen a letter from the Commander of the *Gordon Castle* (Castle line of Steam Packets), who was fortunate enough to save life at sea, and who for his gallant conduct was presented in September last with a Gold Keyless Waltham Watch by the President of the United States, on behalf of the London Local Marine Board. Referring to this Presentation Watch, he says: "When I left London the watch was six seconds fast, and on my arrival at Singapore it was only three seconds slow, a most extraordinary performance for a watch, as I carried it on my person the whole time. I compared it every day with my chronometers on the passage out, and it seldom or ever differed one second from them; in fact, I found it almost, if not as good as my chronometers, which is a great deal to say for a watch carried about and subject to all kinds of jolts."

The Worthies of Horology.

By C. Stuart Murray.

X.

SINCE the publication of my last paper, I have fallen in with some rare antique horological lore which must not be slightingly passed over. Taking the year 1560 as a centre, there lived in the reign of two kings of France the most celebrated scientific personage of his day. This was no lesser a light than Oronce Finée, the celebrated astronomer of Paris. He was also mathematician and mechanist to the king. Upon the well understood constitutional doctrine that "the king never dies; God save the king," Finée held his distinguished post under the two monarchs first mentioned. The first was Henri II., whose reign is interesting to us in so far that it was he who concluded a war with England and got the port of Boulogne back from us on payment of four hundred thousand crowns. It was to his son Francis that Mary Stuart, the Scottish Queen, went to France and was betrothed in the early years of her teens. He was accidentally killed at a grand tournament which was given as part of the festivities upon the conclusion of a double marriage; namely, between his daughter Elizabeth and Phillip II., of Spain, and his sister Margaret and the Duke of Savoy. It was during his reign that Calais, which had been in English possession for more than two hundred years, and had become a very prosperous place, was besieged for only a week, and was re-taken by the French.

Francis was succeeded by his next brother, Charles IX., in 1560, the new king being then only in his eleventh year. But all the trouble of government was taken off the boy's hands by the ambitious, historically known Catherine dè Medici. To illustrate how beauty of person and the contrary of mind have existed in the same personage, I have only to state that the lady named has been described thus: "She was remarkably handsome, clever, and accomplished; but crafty, proud, and unprincipled." Her marriage was purely a political one, and had been concluded between Pope Clement VII. and the king, her husband's father. Such being the case, it need not be wondered at that what we understand as "domestic felicity" did not exisit in the royal home. Upon the death of her husband, she became the real ruler of France, and accountable for all the mismanagement, corruption, and atrocities of her terrible reign, culminating in the horrors of the massacre of St. Bartholomew. What was deemed abominable, even in her day, was, that as soon as any of her five sons reached the age of puberty, she had them purposely provided with every agency of effeminate dissipation, in order that such a voluptuous life would confirm and continue her own unchecked rule over the kingdom;—which it did. Unless contemporary history has dealt very unfairly with her, she was by no means an anchorite in such indulgence, but, in order to silence "slanderous tongues," she took especial care that her own lady-surroundings should be of the same way of thinking and feeling as herself.

From these statements it will be easily understood that the mathematician and mechanist to the king was somewhat out of place in such a court; and so he undoubtedly was, and so much the better for horology. In 1553 he constructed a curious and ingenious astronomical clock for the Cardinal of Lorraine, one of the conspicuous actors in the turbulent events of the Medici period. He published a description of this work of his in 1557, which description I have not been able to verify as being in this country. In 1560, the year that forms the keystone of my information, he made another clock which still exists among the treasures of the priceless horological antique. The clever ingenuity and the beauty of workmanship shown in its construction leave no room for further admiration. As I shall have to use the term "astrolabe," I may as well state at once what that term implies. An astrolabe, then, is compounded of two Greek words, *aster*, a star; and *labein*, to take. Among the ancients it had the same meaning as the armillary sphere, which I explained in a previous article. "To take the stars" in an astrological as well as in an astronomical sense was the object of the astrolabe; it has an earlier as well as a later meaning. The philosopher Ptolemy named any circular instrument so that was used for taking stellar observations; but in the sixteenth and seventeenth centuries it was recognised to signify a projection of the sphere in the same sense as planisphere is used. To the projection, which had a graduated rim, sights were affixed for the purpose of taking star altitudes; when so constructed, it was the constant companion and credential of the professional astrologer. But the astronomers "pure and simple" scornfully ignored the astrological part, and employed the sights and graduated rim solely for the purpose of taking altitudes of the stars. Of course, in one sense every modern astronomical instrument is in some part of it an astrolabe; and, indeed, so have all such contrivances been from the earliest dawn of the science of the stars. Hadley's quadrant, that was invented in 1731, was an instrument that went by the name of its inventor, apart from that of astrolabe; and it was followed by the same philosopher's sextant. According to the ancients, the modern *equatorial*, the altitude and azimuth *circle*, and the *theodolite*, would all be astrolabes; but the astrologer applied the last-named instrument to an extra use beyond that of astronomy.

Astrology, again, means simply the science of the stars, providing that the term was used as we use those of geology or theology. Astronomy, on the other hand, from *astron*, a star, and *nomos*, a law or rule, would mean the law, or rule of the science of the stars. We are told that the words *astrologia* and *astronomia* seem to have been used in the same sense by the Greeks till about the Christian Era.

The subject that I am now treating of is one that long engaged the attention of the most eminent thinkers among mankind, although it has been for many years relegated to the brains of the foolish and the superstitious. Its object was to teach us to judge of the effects and influences of the stars, and to foretell future events by their various "aspects" and situations. It was divided into *Natural Astrology* and *Judicial Astrology*. The former was that branch which is now under the care of the "clerk of the weather;" that is, to foretell changes bearing upon hail, rain, storm, and sunshine, according to the position of certain planets in relation to each other, and to the earth and the moon.

To *Judicial Astronomy* was left the prediction of human events, as if they were brought about by the influence of the planets and stars; and the governing in a certain sense of those moral actions which seem to depend upon the free will and agency of human beings. *Judicial Astrology* was was very much spoken about and "cultivated," even towards the close of the eighteenth century; but the progress of time, science, and philosophy have banished it into the dark abodes of fortune-telling and imposture. At one time all the ancient nations except the Greeks believed in it, so strong is the love of the marvellous in mankind, whilst it also reigned paramount throughout the entire world of the middle ages.

The whole of the visible and invisible heavens was divided into twelve *houses*, and every heavenly body passed all the houses in the twenty-four hours, but not always in the same house with the same star, except at the equator. These houses were shown flat as twelve triangles all within a square. Each triangle was numbered, and a sign of the Zodiac occupied it. This is how these triangles were made, and and how to make them. Draw a square of any dimesions desired. Then inside of that draw another square, the corners of which shall touch the middle of the sides of the large square. Inside that, again, draw another square whose corners shall touch the sides of the one just made in the same way. From each corner of the last square draw a line to the corner of the first made, or outer square of all, and you will have the twelve triangles. For the insertion of signs, dates, and latitudes, the reader must refer to some old work on the subject where illustrations can be compared, as word-explanation would be too tedious here.

The "casting" of nativities, marriages, deaths, wars, tumults, storms, &c., is about the most puerile imposture that can be read anywhere; and yet it was once firmly believed in by both the learned and the unlearned! I must not omit to add that the "houses" have each a name, and a function attached to them by the astrologer. These names are in regular order—life, riches, brethren, parents, children, health, marriage, death, religion, dignities, friends, and enemies. Upon such foundations, or rather imaginations, are built up what we now know to be a structure of worse than imbecile nonsense. The last of the "scientific" astrologers was Morin, for the establishment of the Copernican system was the death-blow of astrology. When it came to be believed that the earth was only one—and that a small one—of the vast planetary system, the absurdity of such a morsel of a globe enchaining the care for it of all the others, the sun included, was not long in sweeping astrology into the dustbin of the silly impossibilities.

And yet, to work in with such a deeply-rooted error, eminent men invented astrolabes, Oronce Finée among the number.

The astrological clock with which we are here more closely concerned, has always been looked upon as a marvel of its kind, even in these days.

The dial work, or that which more properly belongs to astronomy, is rather curious. There is an astrolabe in motion by the clock train, that shows at any hour of the day the following phenomena:—

The relative motions of the sun and moon, and the tides according to the Ptolemaic system. Previous to explaining this system, I may mention that the greatest astromoner among the ancients was Hipparchus, who lived between a hundred and sixty and a hundred and twenty-five years before the Christian era. So great was his work among the stars, that it has been justly said, that if he had possessed the pendulum and the telescope, fifty years of observations by his successors would have enabled them to have placed astronomy in the position which it occupied at the birth of Newton!

There can be no question but that Hipparchus was the greatest of all the Greek astronomers; the dates given about him are those from his birth (B.C. 120), and his death (B.C. 160). The next of importance after him was Ptolemy, of Alexandria, dating between 130 and 150 A.D., embracing a period of about three hundred years. The motion of the Ptolemaic system was that the planets moved uniformly in circles, the centres of which themselves moved uniformly round the earth. He was an astrologer, and his system and the astrology connected with it, occupied the belief of the astronomical world for fifteen hundred years. Tycho Brahe's plan was, that the sun did go round the earth, and that the planets went round the sun. The dial movement of Finée's clock shows the position of certain of the principal fixed stars with relation to the earth, as well as—and here the astrologer speaks out—"as well as the aspects of the heavenly bodies, whether in conjunction, sextile, quartile, trine, or opposition."

These signs were of great importance, when astrology was looked upon as "the exact science." The dial of the clock has four concentric movements showing the course of the sun round the earth in twenty-four hours, his yearly course through the signs of the Zodiac, the ages and phases of the moon, and the tides. Each index, the memorandum says, is a perforated diagram, and serves at the same time as a dial to the one above it; thus showing the relative motion of one body to the other.

The back of the dial is an astrolabe, for making astronomical observations, taking the altitude of the sun and stars, and ascertaining the height of objects on the earth's surface; finding the day of the month, and making other calculations. The usual form of the astrolabe was such that it was suspended by a ring, illustrations of which we have all seen, which suspension required some use and skill to set it correctly. The clock had no fusee, and the wheels were all of steel; and the elaborate instrument touched upon here places Oronce Finée among the earliest and most valued Worthies of Horology. It is related that Gemma Frisius, the Dutch Astronomer, suggested about the year 1530 that clocks in astrolabes might be used astronomically to find the longitude at sea.

I have read that the only best and clear description of the astrolabe was found by Mr. Octavius Morgan in "A Mirror for Mathematics," being a very scarce tract printed in London in the year 1587. It was written by "Robert Tanner." The full title is quite in keeping with the quaintness of the age, and runs thus:—"A Mirror for Mathematics, a Golden Gem for Geometricians, a sure Safety for Saylers, and an Ancient Antiquary for Astrologers and Astrologians. By Robert Tanner, Gent., Practitioner in Astrologie and Physic, &c., &c., &c."

It has, as was the custom of the age, its Epistle dedicatourie" to the Right Hon. Charles Lord Howard, of Effingham. The first chapter is called "The Traveller's Joy and Felicitie," and "declareth the composition of the instrument called the Astrolab," in the following language:—"This present instrument is divided into four parts: the first part doth contain two things; the first is the face or form of the astrolabe, divided into twenty-four hours, after the manner of a middle horologe, with 360 degrees of the æquator, the lines of the divisions being added with their numbers from 10 to 10; and this is termed of manie the limbs of the astrolabe. To this form is joined a certain hollowness, for the imposition of the other parts. This is called the mother of the astrolabe—

Hollowness, the mother of the astrolabe."

In Chapter 2 is given no fewer than thirty-two directions and observations, beginning with how to find out the mother of the sun, and ending with measuring heights and distances. Among all these directions and instructions he takes care not to forget astrology. In Chapter 25, the reader is told how "to find the beginning of the twelve Houses of the Heavens for divers astronomical judgments. As has been pertinently remarked, "there is probably no one instrument of modern time by which so many operations could be performed and so much knowledge acquired."

◆

Large Pearls.—The *Pacific*, of Mazatlan, Mexico, has the following:—The largest pearl in the world has been found recently in Lower California (Mexico), by one of the fishers (or divers) belonging to the firm of Gonzalez & Ruffo, merchants at La Paz (L. C.) The pearl is of the dimension of a lemon, weighing 75 carats, and measures one inch in length, and three-fourths of an inch in width. It took the fisher who opened the shell several minutes to extract the pearl. There is no doubt that the coast of Lower California is very rich. The largest pearl known before was also found on that coast, in Loreto (L. C.), in the time of the Jesuits, and adorned the crown of the Queen of Spain.

Short Essay on the Construction and Manufacture of Low-priced and Adjusted Key and Keyless Going Barrel Watches, with Models.

(*Continued from page* 97.)

The system of manufacture adopted in Clerkenwell, is that which is known as the cottage or chamber system. The several parts of the watch being made by small proprietors in their own workshops, very frequently the word workshop means nothing more than a small bench fixed near the window in a room in which live about half-a-dozen people; this would refer to small branches, such as finishing, pivoting, polishing, and escapement-making. There is a saying attributed to the late Mr. Dent, that "all that an English watchmaker requires to finish a watch is a graver, a drill, bow, and three nails." The severe irony that dictates such a sentence is its best commentary. Yet I have seen a good full-plate watch finished and the escapement made with such appliances—to wit, instead of a lathe or turns, the pinions were pivoted by driving two nails in the bench, then making centres in which the wheels run; a third nail was driven in and used as a rest, and by this means a first-rate set of pinions have been pivoted. The way in which the sinks for the barrel, centre wheel, and fusee were turned out, was, I think, very ingenious; the bows of a broken pair of cutting pliers, valueless, of course, were secured to the bench, two centres were made in the extreme end of the bows, the plate requiring the sink to be turned out was shellacked on an arbour; then by a strong drill bow, was made to revolve between the bows of the cutting pliars. Sometimes it was necessary to obtain the assistance of a little girl to help to keep the pliars steady. The sinks were then turned out by a hand cutter, made out of the tang of an old file. In turning out the centre wheel sink, it was necessary to fit a circular piece of brass in the third wheel sink, and it had to be shellacked in flush with the centre wheel sink, which prevented the abrupt edge of the latter from breaking the cutter.

The way in which the wheels and pallets were made upright in the frames is worth recording. A pivot was made at one end of a short steel arbour, a pointed centre at the other, the exact length of the arbour from the shoulder of the pivot to the point of the centre being the distance between the plates. A small disk of brass about a quarter of an inch in diameter was then driven on the arbour, and turned nearly level with the shoulder; the pivot was then placed in the hole requiring to be uprighted, the disk which had been turned true on the arbour held it perfectly upright, and being made the exact length when the top-plate was put on, the pillar plate and the two plates slightly pressed together, the pointed centre made a slight dent which was the exact upright of the lower hole.

Such methods of working just described—I could, if it was necessary, indefinitely multiply them—does not in any way represent our system of manufacture in Clerkenwell. It is only a rare instance of necessity, arising from the fact that a good workman, through poverty, has had to send his tools to his uncle, in order to get through a financial difficulty. But it would not be too much to add that there are systems of production as far in advance of our best methods of working as our methods of working are in advance of the one described.

The late Charles Frodsham used to say that "a watch is either a work of art, or an article of commerce." It is to a work of art that the workman of Clerkenwell especially addresses himself. He concentrates all his energies on his work; it is the image of his fancy. He looks with pride on his reputation in the branch to which he belongs, which rarely gets outside the limits of his parish. The local superiority he attains is to him no mean thing, and he is not slow to tell you of it. If we may give him a gentle hint, it is that he will moderate the emphasis he puts on that most dangerous part of speech—the personal pronoun I.

When Turner, the great painter, contemplated placing his ideas of a snow storm on canvas, it is said that he went on a voyage to northern seas, where such storms are more vehement and more frequent than in our climate; and when a terrible storm would arise he was wont to ascend the rigging and lash himself to the mast of the ship, in order that he might witness the raging torrents, and be made to feel the fury of the angry elements. Such instances of devotedness to art are comparatively of rare occurrence; perhaps it is fortunate that they are rare, for not unfrequently has it been known that excessive application in a much-loved pursuit has allured until it has killed. Was not Turner a victim to his art.

Of Kirk White it is said:

> "Worn with anxious thought, the frame decayed:
> Pale o'er his lamp, and in his cell retired,
> The martyr student faded and expired."

And the much sought for beauties of Africa brought Livingstone to an early grave. Nevertheless, there should be an intelligent zeal for every profession, and I should very much belie my own conscience, if I did not state that we have men who earnestly desire the prosperity of the English watch trade, and who are working hard with present appliances, hoping to regain lost ground; and who is there that will not laud their ambition. I greatly admire the energies of my countrymen; I often wish they were better directed. Would that I could prevail on these good men to leave their little workshops and go out into the big world with unbiassed minds.

What a Clerkenwell watch manufacturer wants at this juncture, is, any number of workmen who can produce original and grand works of art, at about the price you would expect to pay for a photograph. It is this excess in art work that defeats and degrades. No doubt the refined pleasures of art in moderation are cordial, but in excess they may be made the bane of life.

Dividing and sub-dividing the trade into so many small branches and proprietorships is, doubtless, attended with disadvantage. But it must be remembered that this system of manufacture has produced some of the very finest chronometers, watches, and clocks in the world, and a tree bearing such fruit cannot be altogether corrupt. For many years it has been our privilege to possess a large number of workmen, possessing a very high order of manipulation and intelligent skill. But the mistake he makes is, in not sufficiently considering improved appliances in working: he seems to have an intolerable dread of what he calls, sarcastically, "the blessed introduction of machinery," and many of the erroneous notions he has on this subject is due to the gross neglect of those who are called manufacturers. Conversing the other day upon this subject with one of the most intelligent watch manufacturers in Coventry, and showing him some pieces of machine work from Waltham, U.S., which greatly surprised him in quality and price, he earnestly requested to be allowed to show them to his workmen, adding, "when they see these they will not be so stiff in holding out for price." To this I replied, that the right thing to do would be, first show them the work, and then show them the system of producing it, and you will soon find your Coventry workmen equal to the occasion.

Truly, we must congratulate the advocates of the present system of manufacture on their success in Clerkenwell. They have succeeded in prohibiting every semblance of better methods. They have refuted the doctrine of the survival of the fittest. For a quarter of a century they have had an Institute to advocate their claims. They are able to collect from the trade, annually, a sum of £1000 to defray expenses, and during the past twelve months, a period of unparalleled slackness, a sum of no less than £568 has been paid in salaries to men who are specially engaged to guard and teach their tenets. And all this is done in broad daylight, in the largest, the most progressive, and the most enlightened city in the world.

The great fault of Clerkenwell lies in its unwillingness to move. It is so self-possessed with past greatness as to prevent the admission of counsel. In nature, that which ceases to move ceases to live; everything is progressive and moves onward and upward, even the fixed stars move: but Clerkenwell—never. It is quite possible to attempt things beyond our reach; but the ambition that essays to much is far less culpable than the gross indifference which lets the best of opportunities pass by unimproved.

I will now describe the process by which a watch is manufactured in Clerkenwell; and at the risk of being charged with tediousness, I will give sufficient details as to enable the outsider to judge of the merits of our system. We will suppose the following order is sent to a manufacturer:—

London, Feb. 28th, 1883.

Sir,—Please make one best quality gold keyless going-barrel watch, three-quarter plate, fourteen size, open face crystal, bezel, high numbered pinions, jewelled in twelve holes, scape wheel, and pallet staff working on end stones, double roller escapement, compensation balance. Brequet pendulum spring, without regulator, fully adjusted to the long and short arcs of vibration, to heat and cold (from 40 to 80 degrees Fahreneit), and six positions. The whole to be the best work that can be made in London. Price £

For A—— B——.

The following will be the course adopted by a first-rate manufacturer. First he must obtain a movement—for this he must either send to a tool shop in the neighbourhood, or else to a movement manufacturer in Prescot. Prescot is a small town in Lancashire, 193 miles from London, which has long been celebrated for best movements.

After having procured the movement, and carefully examined every part of it, the pillar-plate is sent to the dial makers for a dial to be made; while the dial is being made, an order is sent to the compensation balance maker to make the balance; when this is procured, the entire frame, dial, fourth wheel, and scape pinion, is sent to the escapement maker, who first files or turns the scape and balance cocks to suitable heigth and thickness, plants the fourth and scape-wheel depths. The frame is then sent to the jeweller to be jewelled in the balance and scape holes. The escapement is then made in the grey, and the wheel and pallets, and roller and lever depths pitched; the frame is then sent back to the jewellers to have the pallet holes jewelled; while this is being done the escapement maker is polishing up the escapement, so that when he gets the frame back he has only to make the pallet staff, and put the escapement together; the frames and dial are then sent to the case maker; when this is made, the middle of the case, together with the frames, dial, and keyless work, is then sent to the keyless maker to be boxed in—that is, to have the pendant and push-piece let into the band of the case, the bow pivotted on, and the winding pinion and button fitted, also to have dog-screws made for holding the movement in the case. The watch will then be ready for the finisher, who will pivot the wheels, run the depths, send then to jewellers, and then polish up the entire movement, get the brass work engraved and gilt, and then put the entire movement together. In the mean time, the case will be engraved with crest or monogram, polished, and pinned up. The entire watch will then be ready for the examiner, who will very carefully examine every part: he will fit the motion wheels, get the hands made, and have such alterations made as are necessary. The watch will then be sent for springing and timing, which will occupy about one month.

The following is the price current for best work in London:—

	£	s.	d.
Movement (6 hard wheels, high numbered pinions) and keyless work attached	1	1	0
Sunk seconds, enamelled dial	0	6	6
Compensation Balance, gold screws, the quarter-screws having gold nuts working on steel screws	0	16	0
Escapement with double roller and ruby pallets	2	10	0
Gold Case (fashion)	1	18	0
Gold, at per oz.	3	6	0
Boxing in, including gold button	0	15	0
Jewelling Balance holes, with diamond end	0	8	6
,, Pallets & Scape, 3rd and 4th at 5/- per pair	1	0	0
Centre Wheel holes	0	10	0
Finishing	2	5	0
Gilding	0	4	6
Engraving	0	3	6
Mainspring	0	1	6
Examining	0	15	0
Hands and Glass	0	3	6
Springing and Timing	2	10	0
Manufacturing—*i.e.*, expenses incurred in bringing together labour and material (many of the workmen living at a great distance, much time is lost in sending to them)	1	0	0

Chronometer Prizes, 1882.

The following is a copy of a letter sent to Mr. V. Kullberg, by the Clockmakers' Company, in reference to the above:—

The Worshipful Company of Clockmakers. Guildhall, E.C.
24th Feb., 1883.

Sir,—A certificate from the Astronomer Royal has been laid before the Court that your Chronometer, No. 4066, stood first at the recent trials, and has been purchased by the Government. In accordance with the Rules prescribed by the Company for regulating the competition, no person who has already obtained the First Prize (a distinction already attained by you), is eligible for a similar award; but they have pleasure in forwarding you cheque for the Second Prize (£5 5s.), and at the same time expressing the gratification with which they have learned from the report of the Astronomer Royal, that the Instrument which has gained for you this Prize is the finest which has ever been on trial at the Royal Observatory. Kindly forward me receipt for cheque.

I am, dear Sir, Your obedient Servant,

(Signed) H. C. Overall,
Clerk of the Company.

Mr. Victor Kullberg,
105, Liverpool Road, Islington.

Among the Gas Lights.

DURING the past week, in common with "all the world and his wife," we went to the Crystal Palace to look at the great lighting exhibition at present going on there. Our object was not exactly holiday making, for the good and all-sufficient reason that the weather of this present month of February has not been, beyond one or two make-believe days, in the humour for such trifling frivolities. To be sure, the sun put in his crimson appearance late in the afternoon, as much as to say, "How are you? Time for me to be off. Sorry that I can't stay—but, you know that just now, I have to turn out a little earlier in the morning than formerly, and also to stay a little longer at this end of the journey. However, my lighting friends in the big glass house will help you to reach supper time very nicely." And with that the noble Sol made his bow, and disappeared through the thick fog. What he said about having to turn out a little earlier in the morning is perfectly correct, for upon looking over the list of his engagements for the year in that diary of his, the Nautical Almanac, we find that he has to be "at business" in the morning before seven o'clock, and does not get away before half-past five, p.m. Furthermore, each morning or so increases upon him, and by the 22nd of March he will have to open shop punctually at 6 a.m., and keep it open until 6.14 p.m., making a late tea of it.

The fact of the matter is, we went upon an exploring tour, to try if we could discover a light suitable for the board or the bench. We entered the Palace, and at once turned our steps in the direction of electricity. There was great brilliancy, but nothing in our way, so we plunged among the blazing gas without more ado, and found ourselves at home, and in a mood to philosophise upon what was above and around us.

Let us inform our readers that the present exhibition is an outcome of an agreement between the Crystal Palace Company and the Gas Institute, to present both systems of lighting before the public as applicable to the every-day, or more properly speaking, every *night* purpose of life. The Institute gathered together a General Committee, from which an executive was appointed, and the formation of the exhibition commenced. That was the right method of procedure, and the confidence of gas-engineers and the public was secured. In addition to this, the Institute issued a small manual for the information of persons interested in the consumption of gas throughout the United Kingdom. What is most singular, almost unaccountable, in the economics of gas-burning is the utter negligence, even ignorance, of people with respect to their gas and gas-fittings. Burners of the worst possible construction, made of the worst possible material, giving only from two-thirds to three-fourths of light for the amount of gas consumed, are daily and persistently used, *because they are cheap*. Gracious goodness! As if an article for which you gave twenty shillings, and by your own obstinacy in declining to use it with intelligence, you only got from twelve to fifteen shillings' worth of value for your money, was *cheap!* Yet such is the delusion, and nothing in the human nature of this world is so heart-breakingly difficult to overcome as the stolid obstinacy of ignorance. People are continually crying out about their "bad gas," and "extortionate" gas bills, but they never think for one moment of inquiring beyond the small journeyman gas-fitting jobber in some small, out-of-the-way back street. Whereas, if they only called in upon men who are gas engineers in both the theory and practice of gas-burning, they might have a pleasant tale to tell, not only about their lights, but about their bills.

The worse than childish notions of gas companies being in concert with gas-engineers, of pumping air into gas to adulterate it, and of making the meter "spin round" against the consumer, would have no existence. The present writer has wasted much time and patience in combating such foolery, until he has even been angrily told that the gas company, in consideration of his standing by it, has given him all his gas "free, gratis, for nothing!" He has even been challenged to show his paid gas bills in disproof of the assertion? The league for fraud has been swept on one side with a few words; the pumping of air into the pipes has been demonstrated to destroy the illuminating power of the gas, whilst the "spinning round" of the meter could only be effected by the poor, robbed consumer either cutting his pipe from the outlet side, or keeping all his taps open.

During the last twenty years, we have made many home experiments with gas lighting, and we have reason to know that, in conveying to others what little information we have acquired upon the subject, we have created the desire for more beneficial knowledge.

Upon looking round in the gas-lighting department, the most complete and effective exhibition is, undoubtedly, that of Messrs. Sugg & Co., of the Vincent-Works, Westminster. There are to be seen the very newest inventions for the increase in lighting power, and consequent economy in gas consumption. We will not speak at present of the large overhead lights, but of those more immediately connected with the art-workman. We saw a newly-patented governor burner, which we have since tested. It is said to be an improvement upon any similar kind of burner that has hitherto been issued. The one that we tried was a five-feet an hour, and we used it as follows: We have a table gas-lamp whose supply-tube is equal to ten feet an hour. We lighted some of the best check, governing, and non-governing five-feet slit burners that we know of, one after the other, and turned the supply "full on." The result, as may be expected, was a hissing roar of the unburnt gas rushing through the flame. We then put on the new governing one, and, in the presence of several gentlemen, lighted it under the same conditions of full pressure as before. There was no hiss, no roar; the flame was quite steady and silent, with a minimum of non illumination near the nib. This experiment was several times repeated, and always with the same result, no tap regulation whatever being required. Upon removing it and unscrewing the outer screw we found that the governing action took place somewhat in this wise: The gas from the supply-pipe does not pass up directly through the nib, but issues from two holes, one on each side, of a stump tube in the centre of the governing cylinder. After passing through these it goes up the cap-case and out through the slit of the nib. In the interior of the small dwarf cylinder just mentioned there is a level "float," upon which rest two upright slide valves. So long as no more gas is entering the burner than the flame can consume, so long will the valves and the float remain at rest at the bottom of the interior cylinder. When, however, an over pressure uprises the float-valve, it closes the outlet holes to the burner in proportion. It will thus be seen that no more gas can possibly reach the burner than what its flame can consume; and such we actually found to be the case after repeated trials.

But the gem of the collection for our special purpose was the Franklin burner, as improved by Mr. Sugg. This burner is a twenty-four hole regulator argand, suitable for table, wall-bracket, or chandelier. Let us try and explain, without an engraving, the construction of it.

The general features of the argand burner are, of course, well known to every one; however, to render the comparison clear, we will just mention them. The chimney of this burner rests on a projection, or ring, attached to the brass frame of the burner. The air passes direct up, both outside and inside the flame cylinder, the chimney being open at the bottom. The consequence of this form of construction is, that the flame itself is peculiarly sensitive to air-drafts; and if the latter are gusty they will blow the flame against the chimney, shivering the glass. Now, the burner invented by Dr. Franklin is somewhat the reverse of this one in one or two details. In the first place, there are two chimneys instead of one, and in the second place the admission of air is quite different. The innermost chimney rests a little above the bottom of the burner, having a space there between that bottom and the lower end of the chimney. The bottom is solid, so that no air can pass upwards through it; upon it, then, is placed the outward chimney, which has been made large enough to allow a clear air space between it and the innermost one. From what is here said, it will be understood that, as the air for feeding the burner cannot pass underneath in a "raw" state, as it were, it is drawn over the lip of the outer chimney, down the space between the two, and up the inner one to the flame, both inside and out. By such an arrangement the external air is heated on its passage to the burner, and the most perfect combustion, hitherto known to the science of gas illumination is effected. Furthermore, the air-shaft danger is effectively got rid of, and room doors may be opened and shut freely with this burner, which will be appreciated as a valuable gain in this direction. The burners, too, being self-regulating, will add considerably to their utility. This is the burner that, for the three artistic trades represented by this journal, namely, the Watchmaker, the Jeweller, and the Silversmith, we can thoroughly recommend. The light leaves nothing to be desired in whiteness and steadiness. The next to it is the flat flame governing burner which has been already described.

We also saw a new universal joint bracket, which is in use by medical men for turning the light of the gas into the mouth, in order to examine the patient's throat; but it is also available for working purposes in our trades. Instead of the stiffness of it depending upon the tightness of the joints, there is a ratchet action that fixes the light wherever it may be adjusted to.

We were introduced to one of Mr. Sugg's horological curiosities, but of good daily service in its way. This is a 24-hour eight day call-bell clock. It is attached by electricity to bells which may be fixed all over a house. An index-hand on the dial is moved to whatever hour is to be noticed, whether it be for rising, breakfast, luncheon, or dinner—which words are also to be seen, and the bell or bells ring away. The clock is, correctly speaking, an eight-day dial, and is warranted a good timekeeper in all it functions.

We also saw an electric burglary-preventor, that will arouse a neighbourhood if any attempt is made to force an entrance by door, window, or otherwise. A suite of rooms in the west gallery has been elegantly furnished by Messrs. Atkinson & Co., which is lighted in accordance with the suggestions of the Gas Institute, by Strode (sun-burners), Grimston, and Sugg. At the last-named stall we saw a collection of small gas-cooking utensils of very tastefully design and "handy" construction. There were many kinds of burners and gas "fixings" besides those to which we have here alluded, but every visitor ought to see the Franklin burner.

Next to the Sugg Company's stall was that of Hulett & Co. with a great number of articles suitable for gas users, but we did not observe anything that called for special notice. At another stall were Messrs. Bray & Co., of Leeds, with a large selection of "special" burners of various forms. They were all on the two-hole and slit principles for producing flat flames. They were spoken very highly of in the circulars that were handed to us; and we also saw some attractive gas-fittings there. Mr. Heron has the duplex burner, by which, it was stated, much gas-saving could be realised. On the stall of Messrs. Parkinson were a great variety of burners and regulators, whilst the Messrs. Strode were also well represented. Of such articles as sunlights, large ventilators, photometers, and cooking apparatus, we did not take much note, as they were beyond the scope of our inquiry; nor could we pay attention to stands where there was nothing special to be spoken of. Messrs. Leoni had cooking stoves and ovens of all kinds and degrees; whilst Mr. Thomas Fletcher, of Warrington, exhibited both gas and petroleum furnaces for crucibles, muffles, and ladles. He had, too, hot and cold blast blow-pipes, and special heating burners for blow-pipe work.

We think that we have now said all that is necessary for our business, and we conclude by recommending a visit to the exhibition whilst it remains open.—C. S. M.

The Stolen Goods Bill.

Under the presidency of Mr. J. H. Johnson, a meeting of refiners and manufacturing jewellers was held at the Assay Office, Birmingham, to receive the report of the committee appointed by the trade in August last to consider the provisions of the Stolen Goods Bill. In clause 3 the committee suggested that there should be no restriction of hours in the time of search. In clause 4 they proposed, in lieu of fines provided by sub-section 1, to render the offender liable for the first offence to a fine of £20, or, in the option of the justices, imprisonment for not exceeding three months; for the second offence to imprisonment not exceeding six months, without option of fine; third offence, to imprisonment not exceeding three years; the third offence to be dealt with by Quarter Sessions. Similar alterations were suggested with regard to sub-section 2. Instead of fines specified in clause 5, the alterations suggested were, for the first offence a fine not exceeding £20, or, in the option of the justices, imprisonment for not more than three months; second offence, imprisonment not to exceed six months; third offence, imprisonment (not hard labour)for a term not exceeding three years; trial in the last case to be at Quarter Sessions. With regard to clause 6, which made provision as to melting, and required the buyer of scrap or defaced metal to keep it in the state in which he bought it for at least seven days, the committee proposed to leave the word "scrap" without any qualification.

The Chairman, speaking as a manufacturer, said that the 6th clause was a most important one to them, because when they were robbed, the stuff was melted down before a detective could possibly trace it.

Mr. Harrold said that the refiners could not agree to the requirement to keep metal received for refining purposes seven days; and as to the keeping of descriptive books, an enormous amount of work would be entailed. If the Act passed as it stood, the business of a refiner in casting-up manufacturers' scrap would be entirely stopped. Three days would be sufficient for all ordinary purposes, and a general description of the property should suffice.

After some discussion, it was agreed that, in addition to "scrap," the words "lemel and cuttings" should be inserted in the clause. In clause 8, the committee dealt with a verbal inaccuracy, and proposed to alter the hours during which melting might take place, to between 7 a.m. and 7 p.m. They recommended that no license whatever granted under the Act should be renewable if the license had, within a period of five years, been convicted three times of offences under the Act. Various other alterations were suggested, and the report was approved.

A vote of thanks was accorded to Mr. Harrold for his assistance as honorary secretary to the committee, and the meeting terminated.

Bronzes.

By C. D. E. Fortnum, F.S.A.

(*Continued from page* 101.)

THE pseudo-classic manner under the influence of the School of David and Chaudet, which rose upon the ashes of the exaggerated but vigorous art of the old régime, had nevertheless dexterous hands to execute what its followers designed. Modelled by the latter artist, cast by Cheret, is a seated figure of Peace, life-size and of cast silver, dated 1806, now in the Louvre. The badly-cast reliefs on the column in the place Vendôme, were modelled by Joseph Bosio (1769-1845), as was the quadriga, surmounting the triumphal arch of the place Carrousel. Perhaps the most able but sensuous sculptor of his time was Jacques Pradier, a native of Geneva (1790-1852), many of whose works have an extraordinary charm, but do not appeal to the higher mental or religious sentiments.

Among the more important bronze works executed in Paris, within in the present century, are the gates of the Madeleine, cast after the models of the late Baron de Triqueti, by Eck and Durand. Their size rather than their excellence of art is remarkable. A striking and energetic work is the equestrian bronze statue of Richard Cœur de Lion in Old Palace Yard, Westminster,—not, however, faultless in its actions or proportions. This also was the work of Baron Charles Marochetti, R.A.; of French parentage, but born at Turin in 1805, nurtured at Paris, schooled at Rome, he worked in his native city, at Paris, and in England, where this group was produced in 1851. His equestrian statues of Wellington, the one at Strathfieldsaye and the other in Glasgow, were executed in Paris. The statue to Lord Clyde, in Waterloo Place, was his last work. He died in 1867.

Bronze Sculpture in Flanders, the Netherlands, and Spain.

In Flanders and the Low Countries, an early and remarkable development of commercial and productive industry led to an equal activity in the various branches of metal work. The great centre of this industry, as applied to the manufacture of bronze and lattent, was at Dinant, where large quantities of *grosserie* (objects in that material for ordinary use) were produced, and whence many able workers emigrated to Germany and France.

Among the more important and early works yet preserved, is a curious brass font in the Church of St. Bartholomew at Liège. Upon this the subjects in *relievo* are executed with considerable artistic power, while the artist's name and residence and the date are recorded by inscriptions: Lambert Patros, of Dinant, 1112. In the Museum at the Porte de Hal, in Brussels, is another, having figures representing the Baptism of Christ, &c., and uncial inscriptions, with the date 1149, and the place of production, Dionante (Dinant). Another, supported on four figures, is in the Hôtel Cluny, at Paris. Sculpture in bronze was, however, but little used. The noble shrines of the Virgin, of 1214, and that of St. Eleutherius, of 1267, in the Cathedral of Tournay, were works rather of the goldsmith's than the bronzist's art.

Abundant as was stone sculpture in the thirteenth or fourteenth centuries, little, comparatively, seems to have been executed in bronze. There is no doubt that the material for all the earlier monumental brasses so ably incised by English hands was imported from the Low Countries and from Cologne; although subsequently of native manufacture. In France, after the decline of the admirable native school of sculpture which prevailed till nearly the middle of the fourteenth century, Flemish influence (as we already observed) became manifest, and retained its power until absorbed into the revival which supervened from Italy. Carving in ivory was cultivated with great success in Flanders, and excellent woodwork was executed; ironwork also attained there to the highest excellence.

Although monumental sculpture in bronze, during the fourteenth and fifteenth centuries, was comparatively weak, the use of incised brasses for sepulchral slabs was much adopted. Some of these, indeed, may almost be classed as sculpture, the effigy of the deceased being executed in very low relief. Painting was the more ascendant art: works by such masters as the Van Eycks and Memling declaring to what a degree of excellence it had attained.

Among the more important Flemish brasses that have been preserved to our days are those in memory of Guillaume de Wenemaer, and his wife Marguerite Brunen, of about 1325, in the Cathedral at Ghent; of later date are those in Notre Dame at Bruges, of 1575 and 1581. Some brasses of Flemish workmanship occur in English churches, as that of 1349, at St. Margaret's, Lynn, in Norfolk; one of 1361, at Newark, in Notts; and fragments of others which have been reworked by English artists on the reverse side (Palimpsest brasses), as those in Mawgan Church, Cornwall.

At Tongres, is a brass eagle and stand, the work of "Johannes des Joses de Dyonants," 1360, and a candlestick ten feet high by the same artist. In Louvain Cathedral is a brazen font of the fifteenth century, with a beautiful iron crane for lifting and supporting the cover; also, a "grille" to the sacrament house. A brass lectern, of the fifteenth century, and a font of the same material, cast in 1444, by Guillaume le Fèvre, at Tournay, are in the Church of Notre Dame, at Hal, in Brabant. Casts of these are at South Kensington (Nos. '72—63, '72—65). The most important work in bronze sculpture and of truthful beauty is in Bruges, the monument of Mary of Burgundy; a work by "Pierre de Beckere orfèvre et fondeur de métaux à Bruxelles," began in 1495, finished 1502. The effigy of the Princess is of gilded bronze, lying upon a black marble sarcophagus, the sides of which are enriched with enamelled coats of arms, &c. The companion monument to Charles the Bold was the work of Jacques Jongelinck, of Antwerp, in 1558, and is very inferior.

The sixteenth century produced many able Flemish sculptors and bronzists, one of the most famous of whom was Gian or Giovanni Bologna, whose art was developed in Italy, and to whose works we have already referred in the Italian section of this handbook. Pietro Francavilla and others also studied in Italy, producing works of great ability in that and other countries. By Adrian Fries, or Vries, an admirable artist in bronze, born at the Hague in 1560, is the fountain of Mercury, executed previous to 1594, on which the figure of Jove's messenger is arrested in its upward flight by Cupid, who fetters his right foot. A bas-relief is in the royal collection at Windsor, the subject of which is Rudolph II. on horseback, surrounded by emblematic figures of philosophy, &c. This is probably the work of Adrian Fries. In the same collection is a fine group, Achilles carrying off Briseis, signed with a monogram composed of the letter F within an A, probably the work of Franz Aspruck, a goldsmith of Brussels, who worked at Augsburg about 1598-1603.

(*To be continued.*)

Crucibles.—The best crucibles are made from pure fire clay, mixed with finely ground cement of old crucibles, and a portion of black lead, or graphite; a little pounded coke may be mixed with the plumbago. The clay should be prepared in a similar way as for making pottery ware. The vessels, after being formed, must be slowly dried, and then properly baked in the kiln.

John Harrison, the Chronometer Maker.

(Continued from page 102.)

WHEN came in the question of compensation. Harrison's experience with the compensation pendulum of his clock now proved of service to him. He proceeded to introduce a similar expedient into his proposed chronometer. As is well known to those who are acquainted with the nature of springs moved by balances, the stronger those springs are the quicker the vibrations of the balances are performed, and *vice versâ;* so it follows that those springs, when braced by cold, or when relaxed by heat, must of necessity cause the timekeeper to go either faster or slower, unless some method could be found to remedy the inconvenience.

The method adopted by Harrison was his compensation balance, doubtless the backbone of his invention. His "thermometer kirb," he himself says, "is composed of two thin plates of brass and steel, riveted together in several places, which, by the greater expansion of brass than steel by heat and contraction by cold, becomes convex on the brass side in hot weather and convex on the steel side in cold weather; whence, one end being fixed, the other end obtains a motion corresponding with the changes of heat and cold, and the two pins at the end, between which the balance spring passes, and which it alternately touches as the spring bends and unbends itself, will shorten or lengthen the spring, as the change of heat or cold would otherwise require to be done by hand in the manner used for regulating a common watch." Although the method has since been improved upon by Leroy, Arnold, and Earnshaw, it was the beginning of all that has since been done in the perfection of marine chronometers. Indeed, it is amazing to think of the number of clever, skilful, and industrious men who have been engaged for many hundred years in the production of that exquisite fabric—so useful to everybody, whether scientific or otherwise, on land or sea—the modern watch.

It is unnecessary here to mention in detail the particulars of Harrison's invention. These were published by himself in his "Principles of Mr. Harrison's Timekeeper." It may, however, be mentioned that he invented a method by which the chronometer might be kept going without losing a second of time. This was during the process of winding up, which was done once in a day. While the mainspring was being wound up a secondary one preserved the motion of the wheels and kept the machine going.

After seven years' labour, during which Harrison encountered and overcame numerous difficulties, he at last completed his first marine chronometer. He placed it in a sort of moveable frame, somewhat resembling what the sailors call a "compass jumble," but much more artificially and curiously made and arranged. In this state the chronometer was tried from time to time in a large barge on the river Humber, in rough as well as in smooth weather, and it was found to go perfectly, without losing a moment of time.

Such was the condition of Harrison's chronometer when he arrived in London with it in 1735, in order to apply to the commissioners appointed for providing a public reward for the discovery of the longitude at sea. He first showed it to several members of the Royal Society, who cordially approved of it. Five of the most prominent members—Dr. Halley, Dr. Smith, Dr. Bradley, Mr. John Machin, and Mr. George Graham—furnished Harrison with a certificate, stating that the principles of his machine for measuring time promised a very great and sufficient degree of exactness. In consequence of this certificate the machine, at the request of the inventor and at the recommendation of Sir Charles Wager, First Lord of the Admiralty, was placed on board a man-of-war, and carried, with Mr. Harrison, to Lisbon and back again. The chronometer was not affected by the roughest weather, or by the working of the ship through the vast rolling waves of the Bay of Biscay. By means of its exact measurement of time, an error of almost a degree and a half (or ninety miles) in the computations of the reckoning of the ship was corrected at the mouth of the Channel.

Upon this first successful trial of his chronometer the Commissioners of Longitude gave Harrison the sum of £500, on condition that he should proceed to make further improvements in his machine. Mr. George Graham urged that the Commissioners should award him double the amount; but this was refused. At the recommendation of Lord Monson, however, Harrison accepted the sum as a help towards the heavy expenses and labour which he had incurred, and was about to incur, in perfecting the machine. He was instructed to make his new chronometer of less dimensions than the first, which was thought too cumbersome and to occupy too much space on board.

He accordingly proceeded to make his second chronometer. It occupied a space of about only half the size of the first. He introduced several improvements. He lessened the number of the wheels, and thereby diminished friction. But the general arrangement remained the same. This second machine was finished in 1739. It was much more simple in its arrangement, and much less cumbrous in its dimensions. It answered even better than the first; and though it was not tried at sea, its motions were sufficiently exact for finding the longitude within the nearest limits proposed by Parliament.

Not satisfied with his two machines, Harrison proceeded to make a third. This was of an improved construction, and occupied still less space, the whole of the machine and its apparatus standing upon an area of only four square feet. It was in such forwardness in January, 1741, that it was exhibited before the Royal Society, and twelve of the most prominent members signed a certificate of "its great and excellent use, as well for determining the longitude at sea as for correcting the charts of the coasts." The testimonial concluded: "We do recommend Mr. Harrison to the favour of the Commissioners appointed by Act of Parliament as a person highly deserving of such further encouragement and assistance as they shall judge proper and sufficient to finish his third machine." The Commissioners granted him a further sum of £500 accordingly. Harrison was now reduced to necessitous circumstances by his continuous application to the improvement of the timekeepers. He had also got into debt, and required further assistance to enable him to proceed with their construction.

Although Harrison had promised that the third machine would be ready for trial on August 1, 1743, it was not finished for some years after. In June, 1746, we find him again appearing before the Board, asking for further assistance. While proceeding with his work, he found it necessary to add a new spring, "having spent much time and thought in tempering them." Another £500 was voted to enable him to pay his debts, to maintain himself and family, and to complete his machine.

Three years later he exhibited his third machine to the Royal Society, when he was awarded the Gold Medal for the year. In presenting it, Mr. Folkes, the President, said to Mr. Harrison, "I do here, by the authority and in the name of the Royal Society of London for the improving of natural knowledge, present you with this small but faithful token of their regard and esteem. I do, in their name, congratulate you upon the successes you have already had, and I most sincerely wish that all your future trials may in every way prove answerable to these beginnings, and that the full accomplishment of your great undertaking may at last be crowned with all the reputation and advantage to yourself that your warmest wishes may suggest, and to which so many years so laudably and so diligently spent in the improvement of those talents which God Almighty has bestowed upon you, will so justly entitle your constant and unwearied perseverance."

Mr. Folkes, in his speech, spoke of Mr. Harrison as "one of the most modest persons he had ever known." "In speaking of his own performances he has assured me that, from the immense number of diligent and accurate experiments he has made, and from the severe tests to which he has in many ways put his instruments, he expects he shall be able with sufficient certainty, through all the greatest variety of seasons and the most irregular motions of the sea, to keep time constantly, without the variation of so much as *three seconds in a week*, a degree of exactness that is astonishing and even stupendous, considering the immense number of difficulties, and those of very different sorts, which the author of these inventions must have had to encounter and struggle withal."

Although it is common enough now to make first-rate chronometers—sufficient to determine the longitude with almost perfect accuracy in every clime of the world—it was very different then, at the time that Harrison was occupied with his laborious experiments. Although he considered his third machine to be the *ne plus ultra* of scientific mechanism, he nevertheless proceeded to construct a fourth timepiece, in the form of a pocket watch about five inches in diameter. He found the principles which he had adopted in his larger machines to apply equally well in the smaller; and the performances of the last surpassed his utmost expectations. But in the meantime, as his *third* timekeeper was, in his opinion, sufficient to supply the requirements of the Board of Longitude as respected the highest reward offered, he applied to the Commissioners for leave to try that instrument on board a royal ship to some port in the West Indies, as directed by the statue of Queen Anne.

(*To be Continued.*)

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An International Exhibition will be opened at Calcutta, on the 4th December next, under the patronage of His Excellency the Viceroy and Governor-General of India, and His Honour the Lieutenant-Governor of Bengal. There will be nine principal sections:—1, fine arts; 2, apparatus and application of the liberal arts; 3, furniture, and objects for the use of dwellings; 4, clothing, including fabrics and objects of personal wear; 5, products of mining industry, forestry, &c.; 6, apparatus and processes used in the common arts; 7, food, fresh, preserved, or in various states of preservation; 8, artizan's workmanship; 9, children's work. Certificates of gold, silver, and bronze medals will be awarded by special juries of experts. An attempt will also be made to hold an exhibition of live stock, agricultural and horticultural products, and of a loan collection of paintings, sculpture, and works of art generally. The India Government has granted the use of the India Museum, together with the grounds and buildings adjoining. It is a magnificent pile of buildings, said to be the very finest in India, situated on the Maidan, facing "Charinghee," close to the Governor's Palace, and in the very centre of Calcutta, and also voted a lac-and-a-half of rupees (£15,000) to defray expenses of the Indian Court. Annexes will be erected to meet further requirements of exhibitors. All goods forwarded for exhibition and addressed to the secretary for that purpose are admitted free of duty. Calcutta is a free port, except for arms, ammunition and military stores, liquors (beer, wine and spirits), opium and salt. Application for space with full particulars of the intended exhibit, must be made at the office of the official Agent for Great Britain, Mr. W. P. Dilworth, 4, Westminster Chambers, Victoria Street, London.

Trade Recipes.

Paste for Cleaning Metals.—1 part oxalic acid, 6 parts rotten stone, mix with equal parts of train oil and spirits of turpentine to a paste.

Soldering German Silver.—Dissolve granulated zinc in spirits of salt, in an earthen vessel. Cleanse the parts to be soldered, and apply the spirits of salts. Next put a piece of pewter solder on the joint, and apply the blowpipe to it. Melt German silver 1 part, and zinc, in thin sheets, 4 parts, then powder it for solder.

Dead Black.—A dead black for the brass work of lenses is prepared and applied in the following manner: The brass work must be made quite clean; then apply with a camel's hair brush, bichloride of platinum 4 drachms, nitrate of silver 1 grain, water 6 ozs. When you get the right depth, wash with clean water, dry, and finish with plumbago.

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Why Boys Dislike to Learn Trades.—The *Blacksmith and Wheelwright* believes that the old system is, in the main, responsible for the aversion that such large numbers of boys manifest for learning trades. For the first year a boy in a blacksmith's shop, for instance, is put to the roughest and most disagreeable work. He is made to do a thousand-and-one things that will be of no use to him when he grows up, and have nothing to do with making him a skilful mechanic. He knows this and naturally rebels and wants to do something that will be of benefit to him. He is brought to feel that to be a good blacksmith, a man requires much brawn and little brains. That he obtains an erroneous idea of the trade he is trying to learn we all know, but, nevertheless, this impression is apt to become fixed in his mind from the character of the work he is put to do. Is it any wonder that he looks with envy on the boy behind the counter, or in a lawyer's office, and longs to get away from an employment which has become irksome?

Curious Letter Sent by a Quaker to his Watchmaker.—"I send thee once more my erroneous watch, which wants thy speedy care and correction. Since the last time he was at thy school, I find, by experience, he is not benefited by thy instruction; thou demandest the fourth of a pound sterling, which thou shalt have, but let thy honest endeavours first earn it. I will board him with thee a little longer, and pay for his table if thou requirest. Let thy whole endeavours and observations be upon him, for he has mightily deviated from the principles of truth: I am afraid he is foul in the inward man—I mean his springs. Prove and try him well with thy adjusting tools of truth, that if possible he may be drawn from the error of his ways. By the index of his tongue he is a liar, and the motion of his body is ever variable and uncertain. I presume his body is foul, as I before observed; therefore brush him well with thy cleansing instruments from all pollutions, that he may vibrate with regularity and truth; admonish him friendly and with patience, and be not too hasty and rash with thy correction, lest, by endeavouring to reduce him from one error, thou should'st fling him headlong into another, for he is young and of malleable temper; he may, with due correction, be brought into the path of truth. In fine, let him visit often the motion of the sun, and regulate him by his table of equation; and when thou findest them agree, send him home with thy bill of moderation, to thy friend Tobias Go-well."

Trade Notes.

MR. J. U. POOLE has been again elected to act as one of the Judges who are to award the medals to the most proficient pupils at the classes carried on at the British Horological Institute.

MR. H. BUSH, of Hull, has introduced a watch protector, which deserves the attention of the trade. It is a protector against dust, dampness, and pick-pockets, at the same time; and it is light and inexpensive. Specimen may be seen at our offices: 11, St. Bride Street.

MONS. DEBRAY, one of the inventors of the "dry" process of refining platinum, obtains platinum and its metals in a crystallised form by melting them together with an equal quantity of iron pyrites and some borax, and afterwards treating the mass with hydrochloric acid. The crystallised metal will be contained in the residue.

WELLS, FARGO, & Co., of Philadelphia, report that the value of the precious metals produced in 1882 west of the Missouri River, including British Columbia and the west coast of Mexico, was—gold, 30,193,355 dols., silver, 50,156,288 dols., the total being 1,140,000 dols. above that of 1881. California and Nevada show a decrease, the other districts an increase.

A NEW church clock has beeen erected at Aylestone, near Leicester. It strikes the hours upon a large bell and chimes the quarters upon two others. It is fitted with all the latest improvements to ensure perfect accuracy of performance. Messrs. Smith, Midland Steam Clock Works, Derby, carried out the work.

An exhibition of Foreign Arts, Products and Manufactures is to be held in Boston, Mass., in September, October, and November. The building contains over seven acres of available floor space, and is said to be admirably adapted for the purpose. As implied by the title, United States Manufacturers will take no part in it, and it remains to be seen if our manufacturers of low-priced watches will supply the place of the exhibits of the American Watch companies.

MESSRS. PORTER BROS., jewellers, Birmingham, summoned William Flavel and Thomas Flavel, trading as Flavel & Son, jewellers, of Unett Street, Birmingham, for that they did apply a certain registered design for the ornamentation of earrings to certain earrings of the defendant's manufacture, and thereby infringe their copyright to such design. The ornamentation consisted of a combination of a fluted crescent fixed upon a disc, and it was proved that the defendant manufactured a similar design on certain earrings in September last. For the defence Mr. Dursett called witnesses to show that the combination had been in use three years before the registration by complainants, and also submitted that the design was not a new and original design within the meaning of the act.—The summons was dismissed.

THE programme of prizes for the twelfth competition offered by the Goldsmiths' Company, with a view to the encouragement of technical education in the design and execution of works in the precious metals, will be found on page 118 of present issue. The prizes will consist of one of £70, one of £50, four of £35, one of £30, seven of £20, three of £15, and three of £10. The Company have also resolved that a travelling scholarship of £100 may be awarded by the wardens to a student who has shown exceptional talent, and who shall have obtained prizes for design or modelling in three years' competition, in order to enable him to study art in the precious metals on the continent of Europe. The prizes will be awarded in the month of December next, and objects of art and workmanship must be sent by the competitors to the Goldsmiths' Hall, addressed to the care of the clerk, on or before November 24th.

THE *Swiss Horological Journal* has the following remarks respecting "Half Chronometers."—"It is not very easy to give an exact definition of a chronometer and a half chronometer; the conditions differ much in this respect. Speaking generally, every time-measuring instrument is a chronometer; but, originally, this name was reserved for those with going fusees and spring detent escapements. In the present day it is sufficiently correct to call an instrument, having obtained a rating certificate from the Observatory, a chronometer. A half chronometer is an instrument furnished with a compensation balance, but which has not been adjusted to temperature. In short, the ordinary pocket watch has not, as a rule, a compensated balance, and it follows it cannot regularly indicate the time with precision."

THE half-yearly general meeting of the Goldsmiths and Jewellers' Annuity and Asylum Institution was held at the Horological Institute, Northampton Square, Clerkenwell, Mr. G. Lambert, presiding. Amongst those present on the platform were Mr. F. Booth Thomas (Past Master of the Goldsmiths' Company), Mr. W. Webber, Mr. R. H. Secker, and Mr. A. J. Dixie. The auditor's report, which was received and adopted, stated that the affairs of the Institution were, owing principally to the munificence of the Goldsmiths' Company, in a very satisfactory state. During the past year the total receipts had amounted to £1,514 12s. 9d., showing an increase of £165 11s. 7d. over those of the previous year. The sum of £823 3s. 10d. had been expended in charity, the funded stock had been increased by £150, and a balance remained of £396 15s. 2d. After the committee had been elected, Mr. Dixie, chairman of the committee, moved a vote of thanks to the Chairman, Mr. Thomas, and Mr. Stephen Smith (Warden), as representatives of the Goldsmiths' Company, for their munificent donation of £1000, and for the increase of their annual subscription from 200 guineas to £500. The motion was carried with great enthusiasm, and the Chairman, in returning thanks, congratulated the Institution that their position was such as to make them worthy of the confidence of the Goldsmiths' Company. Mr. Thomas also returned thanks. Mr. E. Phillips was elected as an annuitant, and Mr. P. L. Veyrasset as an inmate of the asylum.

A WINDOW in Mr. Robinson's pawnbroking establishment was recently broken by a brick, and a diamond ring stolen. The miscreant was chased some distance by the foreman, but ultimately escaped. This is the fourth robbery of a similar kind which has taken place recently. Mr. Harrison, Wardour Street; Mr. Walter, Aldersgate Street; and Mr. Vaughan, Upper St. Martin's Lane, having had windows broken in the same way, and all lost diamond rings.

RILLEY BARRAY, Michael Street, Shoreditch, was sentenced to six months' imprisonment for stealing two gold rings from the shop of Mr. Death, Jeweller, 42, Bishopsgate Street Within. The prisoner was apprehended by Detective Towsey, who had closely watched him while he was in the shop on a pretended intended purchase. He threw away the rings on noticing that he was being observed, but they were picked up and restored to him. It was discovered that he had substituted for them two worthless rings while in the shop. Sir Reginald Hanson said Mr. Death conducted his business in a very loose manner by showing a tray full of valuable rings to a man like the prisoner, and it was entirely owing to the tact and determination of the officer that the prisoner had been brought to justice.

* * *

A claim was brought against the Joint Committee of the Metropolitan and District Railway Companies by Mr. Charles Leech, watch and clockmaker, 59, King William Street, his premises having been acquired by the Railway Companies under their compulsory powers, in connection with the completion of the Inner Circle. Mr. Leech said he occupied the ground floorr and basement of the premises in question under a lease dated 13th March, 1874; and the tenancy commenced on the 25th March. The lease expired on the 25th March, 1884. The rental at the present time was £270 a year, which included rates and taxes: but he had the burden of keeping the premises in repair and painting them periodically. In the early part of last year Mr. Leech, being anxious to secure a longer lease of the premises, took the precaution of going to the solicitors acting on behalf of the railway companies to make inquiries as to whether the premises were really to be taken. He was unable to get any definite information with regard to the matter; and in the month of July last an agreement was entered into between his landlord and himself, by which the lease was extended to June, 1893, at a rental of £300 a year, so that he was now entitled to another ten years and a quarter of tenancy at that place. He carried on a considerable business in King William Street. He sold clocks and watches of all kinds, dealt in diamonds and other precious stones, and did a large business in repairing watches from the auction rooms, which were almost immediately opposite his premises. About last December twelvemonths he took another shop at 19, Little Tower Street, at a rental of £165 for the first three years and £170 afterwards. They were not convenient premises for his business, and were much smaller than his place in King William Street. His profits were over £1,000 a pear, and he claimed £4,000 as compensation. Mr. Edmond Fuller (Fuller and Fuller) valued the lease at £1,125, he estimating the present rent of the premises at £450 per annum, and Mr. Chatfield Clarke and Mr. C. W. Thompson at £400 a year. The jury retnrned a verdict for £1,950.

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The Technical College in Finsbury is now an accomplished fact. An introductory address was delivered by Mr. Philip Magnus (Director and Secretary of the City and Guilds of London Institute), on the 19th ult. Sir Francis J. Bramwell, in the chair. The cost of the building is £30,000, and the funds were principally provided by the Livery Companies. It is a simple piece of architecture, the entrance presenting the only decorative feature, and its principal distinguishing point is the construction on the top floor of a remarkably complete chemical laboratory. The floor of this apartment is concrete, overlaid with asphalte. It provides table accomodation for seventy students at the same time, but it is designed for 140, or, including two rows of side tables specially reserved, 185. About two thirds of the premises will be lighted with electricity and the remainder by gas, which will be essential for many other purposes. On the ground floor in one of the rooms devoted to physical science are two tables for the extremely delicate galvano-meters built up from the basement, the ground floor being apparently wholly disconnected with them. In his address Mr. Magnus reminded them that when twenty-one months ago the Duke of Albany laid the foundation stone he described the building as the first college for promoting technical education in London, and his address would be partly directed towards justifying the epithet used on that occasion. Very few seemed to be able to understand the different kinds of trades to which technical instruction was properly applicable. He proposed to call that education, learning, or instruction technical which had a direct reference to the career of the student who received it. Thus considered, technical education was no new thing, except in careers called into existence by recent developments of science. It was because the system to which we had been accustomed was no longer the best preparation for actual work, and no relation hitherto existed between the boy's learning and the man's career that such colleges were needed. The necessity of technical education he attributed to the invention of the steam-engine and the breaking-up of the apprenticeship system and the tide which was pushing it forward would not subside until it had influenced the educational institutions of the country from the primary school to the university. The Council had been guided by the desire to supplement and not to duplicate existing educational machinery, and the college consisted really of a day school and an evening school. The former would give preparatory training to students for practical work in the factory or engineers' shop, and the evening department was intended to help those already at work to understand the principles underlying processes they saw exemplified in their daily work. The college was therefore a technical school of the third grade, and whilst the majority of the pupils would complete within it their instruction, some will proceed to the technical high school or central institution in course of erection at South Kensington. The college might claim to represent a new grade of school. It was not an institution in which any particular trade might be taught, except it were some art industry; nor would it teach the excellence, precision, and rapidity of execution which could only be acquired in the workshop or factory, where under the severe strain of competition saleable goods were being manufactured. Proceeding to indicate the course of instruction to be given, Mr. Magnus explained that on entering the institution the student would have to declare whether he wished to be trained as a mechanical engineer, an electrical engineer, or with a view to some branch of chemical industry, or whether he wished to study applied art; and the subjects would be taught with special reference to the career of the student. The teacher would keep steadily in view the purpose to which the student would apply his knowledge, and would be so constituted as to keep one eye on the principles of science and the other on the occupation of the student being prepared by him. The work would be essentially practical, and more would be done in the laboratory than in the lecture room, the lectures forming rather a commentary on the practical work than the practical work on illustration and the teachings of the lecture room. The main purpose was not to turn out the scientists, but to explain to those preparing for industrial work the principles that had a direct bearing on their occupation, so that they might be able to trace back the principles they saw to their causes, and thus substitute scientific method for mere rule of thumb. Of the four departments of the college—electrical engineering and applied physics, mechanical engineering and practical mathemathics, chemical and applied art—that of electrical engineering promised to be the most attractive to students. In conclusion, Mr. Magnus hoped the college would do much to wipe away the reproach of the neglect of technical education under which the country had hitherto lain compared with other countries.

TECHNICAL EDUCATION.

GOLDSMITHS' HALL, LONDON.

1883.—TWELFTH COMPETITION.

With a view to the encouragement of Technical Education in the Design and Execution of Works in the Precious Metals, the Goldsmiths' Company of London have settled the following Programme of Prizes for the current year:—

£70. A Prize of £70 for the best Model in Plaster, or other suitable Material, finished, ready for casting, of a group "Highlander bringing home dead Deer on Pony," the extreme height of the man not to exceed fourteen inches.

£55. A Prize of £35 for the second best Model.

£50. A Prize of £50 for the best design for a Racing Prize (value £300) of a Ewer and Dish for Repoussé Work, the handle alone to be cast. The Design must be accompanied by a working Drawing for the hammerman, and a model in plaster or wax of the principal subject on Ewer or Dish.

£35. A Prize of £35 for the second best design.

£20. A Prize of £20 for the third best design.

£30. A Prize of £30 for the best Specimen, executed in Repoussé Work in Silver, of a Panel containing two boys by Donatello, a copy of which may be procured by intending competitors at Goldsmiths' Hall, upon payment of a sum of of 7s. 6d., which sum will be returned to every actual Competitor. The subject to be of the height of 11 inches and a-half, the width to be in proportion.

£20. A prize of £20 for the second best specimen.

£35. A Prize for £35 for the best Specimen, executed in Repoussé Work in Silver, of a Relief of three boys by Thorwaldsen, a photograph of which may be obtained by intending Competitors at Goldsmiths' Hall. The work is to form the top of a Lady's Handkerchief Box, Bridal present, with wreaths of flowers and doves above, and a Panel for initials below, dimensions 5½ inches by 7 inches, projection of Relief ⅛th of an inch. A rough suggestion for the wreaths will accompany the Photograph.

£20. A Prize of £20 for the second best specimen.

£35. A Prize of £35 for a Lady's Hand Mirror in Silver, outline of dimensions to be given. The handle and junction to be ornamented as in a Photograph from Stephanus de l'Aulne, 1561, a copy of which may be obtained by intending Competitors at Goldsmiths' Hall. The back of the Mirror to have flat chased ornament of the same date, leaving room for a shield for monogram or initials. A model in wax or plaster must accompany the Mirror.

£20. A Prize of £20 for the second best Specimen.

£10. A Prize of £10 for a Cigarette Case in Silver, engraved or chased.

£10. A Prize of £10 for a Mustard Pot in Silver, with handle and Lid, and not to exceed three inches in height, hammered, and decorated with delicate chasing or engraving.

£20. A Prize of £20 for a Silver Waiter, 13 inches in diameter, hammered and flat chased, or engraved, style Italian Renaissance.

£15. A Prize of £15 for the second best specimen.

£20. A Prize of £20 for a Manufactured Silver Frame for Cabinet sized Photographs, with perforated work around the frame.

£10. A Prize of 10 for the second best specimen.

£15. A Prize of £15 for the lightest and soundest specimen of Core Casting in Silver (the jets to be cut off and the seams from the Mould to be left absolutely untouched), combined with fineness of the Seams, of a Bust of Ariadne, a copy of which may be procured by intending Competitors at Goldsmiths' Hall, upon payment of the sum of 5s., which sum will be returned to every actual Competitor at the close of the Competition.

£15. A Prize of £15 for a Silver Glove Box, twelve inches by three inches, shape simple in form, ornament engraved in the style shown in a Photograph which may be obtained by intending competitors at Goldsmith's Hall, but re-arranged.

£20. A Prize for £20 for a similar Silver Glove Box, with very flat chasing well finished.

The cost of the manufactured articles is not intended to include the expense of Designs, Models, Patterns, or Dies.

Everything offered for Competition must have been made within the present year, and by a British subject, and the prizes will only be given to the actual executants.

All Designs must be drawn, and all Models made, to exact size.

Any partial gilding must be shown on each Design, or Model.

An indication must be given on each drawing, showing which parts are to be hammered, which chased, and which cast and chased.

Originality shall be necessary to obtain either of the Prizes for Design.

The Prizes will be awarded in the month of December next, and objects of Art and Workmanship must be sent by the Competitors to Goldsmiths' Hall, addressed to the care of the Clerk, in the week ending the 24th of November, between the hours of 11 o'clock a.m. and 4 p.m.

Each Object shall have a *Word or Motto* (not a device) attached to it, a counterpart of such Word or Motto being put on the outside of a sealed envelope addressed to the Clerk, and containing within it the name and address of the Competitor, which envelope will not be opened until the Prizes shall have been awarded, and any Object shall be excluded from a Prize if any indication be given of the Competitor.

Competitors for two or more Prizes must put the same *Word or Motto* upon every Design and Object sent in for Competition, and they must state distinctly in each case for what Prize they are Competing.

The Objects sent in Competition for Prizes shall be left until the 1st of March, for exhibition by the Goldsmiths' Company, if the Company shall think proper to cause them to be exhibited.

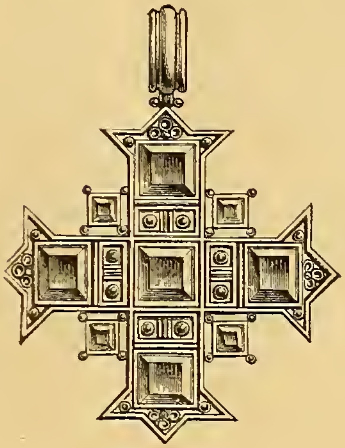
Competitors may, if they please, mention a price for which they are willing to sell the Design or Object exhibited, and the Copyright therein.

The Company reserve to themselves the right to withhold the Prizes for the several objects before mentioned, or either of them, if they shall be of opinion that no Object of sufficient merit shall have been submitted to them.

The Company have also resolved that a travelling scholarship of £100 may be awarded by the Wardens to a Student who has shown exceptional talent, and who shall have obtained Prizes for Design or Modelling in three years' Competitions, in order to enable him to study Art in the precious metals on the Continent of Europe.

Goldsmiths' Hall, *January*, 1883. WALTER S. PRIDEAUX, *Clerk of the Goldsmiths' Company.*

MONTHLY SUPPLEMENT OF DESIGNS.



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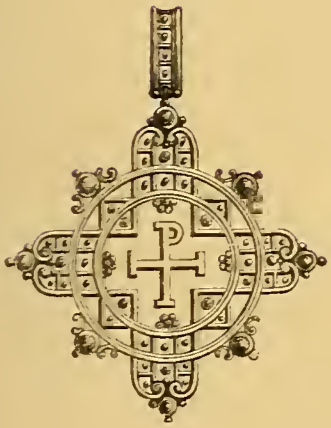

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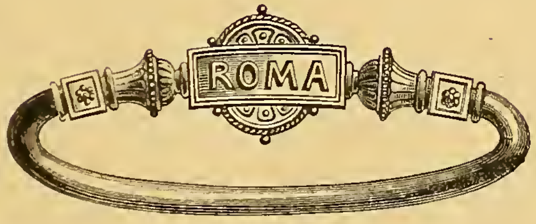

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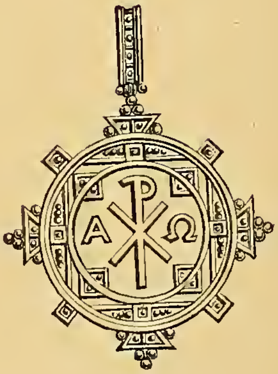

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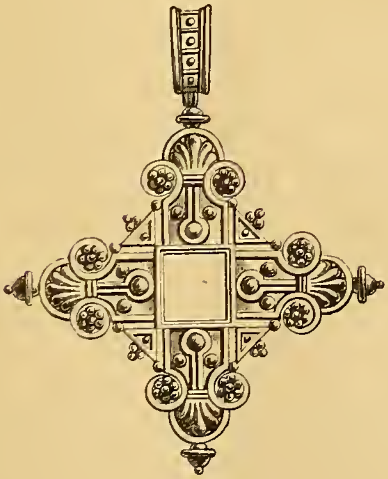

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THE
WATCHMAKER
JEWELLER
AND SILVERSMITH

EDITED BY JAMES U. POOLE.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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Our Prize Competition.

In the January number of this Journal a notification appeared, stating that the Proprietor, Mr. A. Fischer, had offered £50 as a moiety of a fund of £100, to be given in prizes for two essays on subjects calculated to improve the English watch trade. We are glad to be able to announce that the second half has been more than promised, and we hope to arrange the terms of competition, together with the titles of the essays and the names of the judges, before our next issue. In the meantime, we shall be grateful for any suggestions which may be offered us. As two distinct subjects have to be dealt with, we have decided to take them *en seriatim*, and the list of subscribers will be published immediately after the payment of the first £50, which we hope will be claimed either in August or September.

The contest is to be an International one; every competitor will have a fair field and no favour, and we shall be disappointed if practical results do not arise from the publication of the essays.

The Editor and the Horological Institute.

In our introductory article last month, we purposely omitted making any reference to the Horological Institute, as we had fully expressed our personal feelings in the previous number, and furthermore we were desirous of giving time for the manifesto to be fully digested.

Since then, we have attended a council meeting, and the impression given by the demeanour of a few of the members then present has decided us in carrying out a partly formed resolution to withdraw from the active duties with which we had been entrusted.

We have therefore sent in our resignation as a member of the Finance Committee and Visitor to the Classes, also as one of the Judges for awarding the silver and bronze medals of the Institute to the most proficient pupils.

This is not done in a spirit of hostility, but for two good and sufficient reasons; the first being, that our position of editor of this Journal must necessarily bring us into friendly competition with the official organ of the Institute, and we do not wish to be under the suspicion of gaining private information as to the movements of our friends, as we intend to deal only with matters of public interest and common knowledge.

Secondly, we believe in concentration of purpose. Be a whole man at *one* thing, at *one* time, is a good old common-sense maxim; and the additional work entailed upon us by the responsibilities we have undertaken will absorb all the time that we can spare from our own business.

We hope that the *Horological Journal* will increase, both in spirit and in circulation. Competition is the life of literature as well as of business, and as far as it can be done in print, we hereby shake hands with its respected editor, and all connected with the management of the Institute. Having done that, we shall do our best to keep *The Watchmaker, Jeweller, and Silversmith* a little ahead.

Wages of Watch Jobbers in Paris.

An interesting article on the above subject, from the pen of M. Saunier, has recently appeared in the *Revue Chronométrique,* of which we place certain extracts before our readers.

It is often said that the prerogative of an Englishman is to get on and grumble. On most social questions the reflection is sure to be made,—they manage things better in France; but on this particular subject it would seem that we are very much in the same boat.

The *Revue* says: "Our article of pure statistics, since it was extracted from some Government publications—Wages in Paris—has procured us many letters from the departments, and Paris. Their publication, side by side, would offer a curious spectacle, by the fact of their absolute contradiction.

Some departments write thus, in substance:—

"The working watchmakers of Paris are happy to be assured of earning six francs a day. At the present time, everybody sells watches, the business in which, in consequence, passes by, to a great extent, the established watchmakers; and besides, you are not ignorant that since a certain number of manufacturers deal directly with the public, and inundate us with a detestable class of watches, the price of repairs descends more and more, and varies, according to the localities, from 1½ francs to 3 francs a watch. At this price it is impossible to conscientiously do the necessary work, for the watchmaker to have the certainty that a watch will go well. Would that the responsibility of the master and workman finished with the delivery of the article repaired; but no, this responsibility follows them a long time, and the 'further corrections' generally pour on them in such quantities, that they see them accumulating on their work-boards, and are obliged to *correct gratis* a good third part of the watches that they have only *cleaned;* for in the majority of cases they could do nothing else to them."

This is then the situation of at least eight out of ten of the small masters working at the board and the journeymen.

The correspondents are naturally anxious to know if nothing can be done to alter this vexatious state of things, and M. Saunier, before answering their questions, informs them that a watchmaker (whose name and address he considerately withholds, in order to prevent his being beset by applicants) has written to say that those workmen who only earn six francs a day are *incapable* of earning more, and that he pays himself eight and nine francs for a day of ten hours. This gentleman is asked the following questions:—

1st. Watches of a low price and of bad quality are literally deluging the market. *Can anyone properly repair such watches.*

2nd. It is a good old truth, that everyone ought to be able to live by their occupation; and when one knows that at the houses of at least a third part of the established watchmakers, charged with absurd rents and general expenses, the price of the greater part of watch repairs, paid by private persons, fluctuates from four to seven francs, *how much can anyone get for themselves after paying nine francs a day to the workman doing these sorts of repairs.*

3rd. The renowned houses, and some watchmakers who have secured the confidence of their customers, may be able to still maintain their remunerative prices, *but what is their number?*

The following extracts are then made from a deluge of "lying circulars" raining upon Paris and the provinces, which strongly resemble similar announcements here.

	Frs.	Cents.
A watch, eight *Rubies*, Cylinder, &c., &c., sold everywhere else for 150 francs, at least;—at our house	90	00
Lever *Chronometer*, Metal, Keyless, &c. ..	25	00
Guaranteed Repairs from two fr., fifty cents. to	3	00
Fitting a Watch Glass	0	15
A New Brass Hole	1	00
A Mainspring	0	75

When the public, into whose hands they slide these catch-penny puffs, for they are nothing else, refuse to accord an entire confidence to the generality of watchmakers, how will they be able to pay to the workmen [as they ought to be paid] a suitable price, that is to say, much superior to the price indicated on the small papers, which sully our footpaths, or blacken the columns of too large a number of our journals.

[We can only repeat M. Saunier's questions.—Ed. *W. J. & S.*]

The Foreign Exhibition.

The following bill has been reported by a committee of the Massachusetts Legislature:

Whereas, it has been announced to the Senate and House of Representatives of Massachusetts, in General Court assembled, that an American exhibition of foreign productions, arts, and manufactures will be opened in Boston on September 1, 1883; and

Whereas, it is believed that the interests of the manufacturers of the state and of New England will be largely benefited by the opportunity to study the advance made by foreign nations since the Centennial Exhibition at Philadelphia in 1876; therefore, [*]

Resolved, That the legislature of Massachusetts deems it proper to recognise the great value of the proposed exhibition of foreign products, to be held in Boston the present year, by joining in the reception of such foreign representatives as shall visit Boston during the progress of said exhibition; be it therefore,

Resolved, That a special committee, to consist of two members of the Senate (to be appointed by the president of that body), be appointed to coöperate with the general manager of the exhibition in such manner as shall best subserve the interests and contribute to the success of said exhibition.

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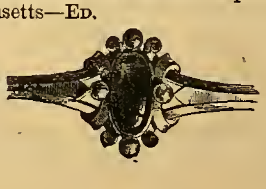
[*] Our readers will please note the significance of the word "therefore." English manufacturers do not desire "Protection," but our Legislators might advantageously imitate the national spirit manifested by the Senators of Massachusetts—Ed.



Hints to Watchmakers on the Preservation of Health.

(From Saunier's Hand Book.)

SOME of the following directions may perhaps be considered to be over minute and restrictive; but they are not so. *Good habits contracted in youth are easily maintained,* and, when the watchmaker has tried them long enough to convince him of their influence on his health, he will experience no difficulty in keeping them up.

The Sight.

When working at any small mechanism, such as a watch, it is necessary to use the glass, but this practice is apt to produce inflammation of the conjunctiva or cornea, and a weakening of the eyesight; a too frequent and prolonged use of the glass will have the same effect as using spectacles that are too strong.

In order to preserve his eyesight, the watchmaker should take the following precautions:—

He should not retain the glass at his eye by a contraction of the muscles for more than a brief interval of time. The glass holder, which can be at once set in any desired position, has therefore much to recommend it.

Drill a few holes in the frame of the glass to avoid, or at least diminish, the inconvenience that arises from the heating of the enclosed air, as well as from the deposition of moisture on the surface of the glass.

Do not use glasses at too great magnifying power; they needlessly fatigue the eye.

Only use glasses that are truly achromatic. If compelled to use the ordinary simple glass, place a ring of dead black paper inside the frame and against the lens, which, by diminishing the field of view, will reduce the inconvenience due to spherical aberration.

It is hardly necessary to advocate the use of a green card-board shade to the lamp, as they are so generally used by watchmakers.

It should be so arranged as to protect the head and eyes from radiation, and card-board is preferable to metal, since it radiates less.

Working at night and by artificial light, more especially by the dazzling light of gas, fatigues the eyes much more than with ordinary daylight, and the workman will find it a relief, if obliged to work by artificial light on very minute objects, to rest his eyes frequently on large stationary bodies. If he can do so, it is a great comfort to bathe the eyes in cold water.

It is a good practice to habituate oneself to the use of either eye with the glass.

By adopting these simple precautions, how many of our fellow-workers who are now only able to see objects indistinctly, and suffer from incipient blindness, would have preserved their sight uninjured. And there is yet another precaution that has been pointed out by Dr. Haltenhoff, of Geneva. He has shown that by *avoiding an excessive indulgence in alcoholic drinks or tobacco,* many old watchmakers in that town have succeeded in preserving their sight unimpaired, and it is impossible to doubt the truth or over-estimate the importance of this fact.

The same authority draws attention to the necessity of taking care that, before adopting watchmaking as a trade, youths should ascertain that they do not suffer from progressive near-sightedness, which is often hereditary, as in such a case they would most certainly be compelled to abandon it in after life.

Boys should not be set to work on such small objects as the details of a watch too early in life, before the membranes of the eye have assumed a certain degree of rigidity.

Mr. Brudenell Carter, a well-known opthalmist, is of opinion that the habitual use of the glass by watchmakers has the effect of actually developing and preserving the power of the eye.

The Body in General.

It is often found that an old, or even a middle-aged watchmaker, is irritable, often tired and soured. This arises, not so often from an over-excited uneasiness in regard to his trade, an explanation that is usually urged, as from a derangement of his digestive organs, brought about by the habit of life he is compelled to adopt. Prolonged working at minute horological mechanism is perhaps more wearying to the mind or body than any other trade or occupation.

To avoid its ill effects, the watchmaker should adopt the following precautions as far as possible:—

Do not use a stool with stuffed seat, but prefer one of cane or wood.

Take care that the relative heights of the board and stool are such that an excessive compression of the muscles of the chest, &c., is avoided during any long operation that renders it necessary to maintain the body in a constrained position.

A stool with adjusting screw, similar to a music stool, is convenient from this point of view.

Change the position as much and as often as possible, especially when working with the file or graver. With this object in view, many workmen have a second board of such a height that they can work standing.

When using the lamp, let it always be provided with a card-board shade, as already recommended.

A screen to protect the head from the direct heat of the flame is often found advantageous; in fact, the watchmaker should adopt the advice of Böorhaave: Keep the head cool and the feet warm."

Let him always remember that nothing does more harm than sitting to the bench immediately after a meal. He should allow an interval of half-an-hour to elapse, and with some temperaments even this is not enough. During this period he should only do work at which it is possible to stand. A little exercise, such as a walk that is not hurried, will be still better: it will stimulate the circulation and stretch the muscles that have been maintained in a constrained position for a long time, through the prolonged attention and slight motion that his labours involve.

[The Italics are ours.—Ed.]

◆

Correct Length of Lever, etc.—It is quite frequently necessary to determine the correct length of the lever, size of table roller, size of the pallets, and depth of the escapement of lever watches. A lever, from the guard pin to the pallet staff, should correspond in length with twice the diameter of the ruby-pin table, and if such a table is accidentally lost, its correct siz emay be known by measuring half the lever between the points above named. For correct size of pallet, the clear space between the pallets should correspond with the outside measure on the points of three teeth of the scape wheel. The only rule that can be given without the use of diagrams, for correct depth of the escapements, is to set it as close as it will bear, and still free itself perfectly when in motion. This may be done by first placing the escapement into your depthing tool, and then setting it to the correct depth. Then by measuring the distance between the pivots of the lever staff and scape wheel, as now set, and the corresponding pivot holes in the watch, you determine correctly how much the depth of the escapement requires to be altered.

An Iniquitous Tax

A ROMAN poet represents one of his actors, in a well-known comedy, as objecting to a contest in which his antagonist is to do all the fighting and he himself to receive all the blows. He ejaculates:—"*Sirixa est, ubi tu pulsas, ego vapulo tantum.*" The situation is evidently one which commends itself to British statesmen. It used to be the boast of England that no injustice could continue under British rule, when once it was recognised by that name. Yet in her dealings with India the mother-country is content to preach free trade, but not to practise it. In deference to Manchester opinion India has lately surrendered a revenue derived from the taxation of cotton imports, which was not felt in India, but which was open to objection as something very like an infringement on free trade. A few months later the Government, which had given such substantial proof of its adhesion to the doctrines of the strictest sect of free traders, endeavoured to compensate India for its loss of one source of revenue by developing a home industry in iron. There was no question of purchasing an inferior article at a higher price than, or even at the same price as, a superior imported article. The attempt was to give the custom of India to an article produced in India of the same value, and at the same price, as the English article. But English iron-masters were at once up in the arms. The word "voters" was whispered in the lobbies at Westminster beneath the clock, and in an instant the policy was checked by orders from home, under the assumption that beneath it lay a secret attack on free trade principles. India must not stray one jot from the path of free trade laid down for it by England. But apparently England may. In short, the contest between the two countries is rapidly being reduced to the condition described by the Roman poet. India is to get all the knocks, and England all the halfpence. If India is ever to be treated as a free country, as she has lately been encouraged by proclamations of self-government schemes to think herself, it is essential that her relations with England should be governed on equitable principles. There must be a fair field and no favour between the trade of the two countries. With less than this India will not be content. She is not in a position like the Colonies to refuse to hear the voice of the charmer—charm he never so wisely. She cannot close her ears to orders from home, inculcating a free-trade policy. But she can demand that her advisers should follow their own advice, and act as they preach.

The duty upon silver plate in England is a direct violation of free trade principles, and it affects India more than any other country in the world. It affects it directly, as well as indirectly. Directly, because the silversmith's trade is one indigenous in India, and in which India can compete successfully with the world; indirectly, because silver is depreciated in the market, and any opening which will create a demand for silver will at least prevent further depreciation of that metal, if it even fails to appreciate it. The history of the duty is interesting. A tax of sixpence per ounce was levied in 1719 to pay for the Spanish war. Forty years after the duty was taken off, and the object was publicly stated to be the encouragement of the trade. The expense of the American war compelled the Government to retract a liberal policy, and the duty was re-imposed in 1784. Within the next thirty years it was raised successively to one shilling, fifteen pence, and eighteen pence, at which point it still remains. Possibly the necessities imposed on finance by the French war justified the tax in 1815, but much has happened since then, and the retention of the duty is not merely a relic of a policy which has long since been abolished; but it involves an injustice to India which recent events have emphasized. It is needless to dwell on the effects of protection. Within this century taxes have been abolished on twelve hundred different articles, and commerce has answered to their reduction by gigantic strides. With the silver trade, hampered as it is, the reverse has happened. Twenty-five years ago the weight of silver upon which duty was paid amounted to nearly one million ounces. In 1880 it was paid on 638,620 ounces; so that, in a period of unexampled prosperity, when a new layer of society has risen to wealth and position with all its attendent demands, the output of the British silversmith has fallen to less than two-thirds of what it was. Other restrictions besides the duty have contributed to this cause. A silversmith must take out a license, which costs him £5 15s. per annum. There is also the charge for Hall-marking. The history of Hall-marking dates from A.D. 1300, when the leopard's head was marked on silver articles after assay. The Goldsmiths' Company, who obtained a charter in 1327, shortly afterwards added the "Owners' and Sayers' Marks"; and the fourth mark of the King's head—the duty mark—was added in 1784. Now, it is essential to understand the system of Hall-marking, as it bears very directly on the Indian-made article. An Indian silver article may be admitted into England on payment of the duty. But it cannot be sold unless it is Hall-marked at one of the various assay offices under a penalty of £10. The process of marking involves scraping and assaying, which, if it does not injure a delicate piece of Indian manufacture, at least necessitates its return to the workshop. It is urged by Sir George Birdwood that Hall-marking is essential, as giving the public confidence that the article is what it appears to be. But the same argument would apply to pictures, precious stones, and even pork—if Sir George Birdwood will pardon the antithesis—regarding all of which the customer is usually content with the guarantee of a respectable tradesman. Restrictions and protection will always find some advocate to justify them. But we are inclined to agree with Mr. Watherston that the proper remedy is to make Hall-marking optional, and the market will, we have no doubt, soon take care of itself.

So long as the present heavy duty on silver continues, and the prerogatives of the Goldsmiths' Company are retained, notwithstanding that they are obsolete political survivals, it will be impossible for the silver trade to flourish. In England it is declining, and the natural taste and capacities of Indian art are entirely excluded from their legitimate market. A striking illustration of the practical effect of these restrictions was given by Mr. Holborn at a meeting of the East India Association. He mentioned that 33 lots of beautiful Kashmir work were advertised for sale and offered twice or thrice, but not a single silversmith would bid for them. On another occasion a well-known firm of Indian merchants offered for sale 310 ounces of the most elegant *repoussé* work, which consisted of raised designs and ornaments, beaten out by the most delicate tools. The work was returned to India for sale, as the difficulties in the way of disposing of it in England were insurmountable. Yet everyone who has been in India appreciates the beauty of Indian work, and no presents are more valued at home than the hand-hammered silverwork of Kutch, Trichinopoly, or Kashmir, and the delicate wares manufactured in Delhi, Cuttack, and almost every native bazaar. We have one more instance which illustrates a further, and even greater difficulty. The law requires eleven ounces two penny-weights of fine silver to the twelve ounces troy, and it may be asked how the native workman can possibly estimate the percentage of pure silver. Not much more than a year since a well-known English firm in Madras sent some 25 pieces of Indian silver work, consisting of cups, spoons, and goblets, weighing 335 ounces, and worth Rs. 2,500. They were made out of rupee silver. After paying the heavy import duty, they were sent to be assayed before being offered for sale, and were condemned as below English standard. The whole parcel was completely smashed up and battered beyond recognition, as the law allowed neither appeal nor option. Now the English firm had not the slightest knowledge that rupee silver was below the English standard, which is a fineness arbitrarily adopted by the Hall, and is below the French standard. It was well known that no attempt had been made to defraud. The duty had been paid, the essay invited, and yet the merciless rigour of protection destroyed without appeal the careful labour of the Indian workman.

We think we are justified in defending Indian interests against arbitrary rules, which must destroy a valuable trade. Protection in this case is not merely protection of the home industry, which is itself stifled by the restrictions imposed on it; but it is the protection of a monopoly which is opposed to the whole spirit of free trade and of the nineteenth century. It has been estimated that the withdrawal of the duty would alone reduce the cost of silver work by two shillings, or even half-a-crown, per ounce. Experience justifies the assertion that such a reduction would alone give an enormous impetus to the trade, and stimulate demand. But the duty is only half of the question. The Hall-marking is an interference with supply and demand which is even more mischievous than the duty. No arguments are wanted to add force to the logic of the fact. If an English firm can be subjected to such treatment as described, with all their opportunities of learning the requirements of the Goldsmiths' Company, what chance is there that the ordinary native silversmith can successfully cope with a difficulty which defeats an enterprising English firm? The question then arises, whether public opinion in India is willing to acquiesce in a policy which simply denies to India, whilst it exacts from this country, something more than an adherence to the principles of free trade as interpreted by Manchester.

English statesmen are well aware of the agitation in the matter which has been started in England by the most disinterested efforts, which aim merely at giving fair play to Indian enterprise and native interest. That with his full knowledge of the fact a liberal Prime Minister declines to act is a result due entirely to the absence of effective agitation in India. The Government of India is bound to protect native interests, and the country will expect its representatives to take a straightforward line. The Indian Press must assist the efforts of the Government. The facts have only to be known in order to raise a storm of indignation. We maintain that the tea trade ought to be entirely freed, but it is enough for the present to urge the abolition of the duty on silver, and the practice of Hall-marking. The issue is perfectly simple. Can restrictions abolished in other articles of trade be retained in this instance? Can England insist on the abolition of custom duties, and refuse to surrender the duty on silver? Is one rule to be applied to the dealings of India with England, and another to those of England with a country which can only successfully struggle against famine by developing its industries? It is time that these questions should be faced, and the country naturally expects that its Government should not shirk the responsibility of compelling the Secretary of State to give a clear answer to them. We entirely misapprehend the vigour and honourable independence of our present Viceroy if he is content to sacrifice the interests of the country committed to his care, and defer to party tactics in a matter where justice to India clashes with the selfish aims of a monopoly, honoured by time, but condemned by political economy and experience.—*The Pioneer Mail of India.*

Mr. Whittaker writes:—"In last number, page 110, line 13, col. 2, read 'arm' for 'hard.' I regret my last paper does not bear my Signature.

Clockmakers' Company Annual Prizes.

As it has come to our knowledge that the conditions for competition are not thoroughly understood by chronometer makers, we reproduce them *in extenso*:—

1. The Clockmakers Company, with a view to encourage the highest excellence in the production of the Marine Chronometer, on which Navigation so largely depends, have determined to award annually two Prizes to the makers of the two Chronometers which shall perform with the greatest accuracy, and respectively stand first and second (as tested on the criterion adopted by the Astronomer Royal, and be so certified under his hand) at the annual trials for Government purchase, at the Royal Observatory, Greenwich.

2. The First Prize will consist of a sum of Ten Guineas, together with the Freedom of the Company, and the Second of a sum of Five Guineas, without the Freedom.

3. The Company reserve to themselves the right to modify the above Prizes from time to time, as they may deem expedient, or, in the absence of sufficient merit, withhold them altogether.

4. Any maker or firm depositing a Chronometer at the annual trials, desirous of competing for either of the above prizes, shall have the name of such maker or firm, and a distinguishing number legibly engraved, *both on the dial and upper plate of the frame*, and shall prove to the satisfaction of the Court of Assistants (if necessary) that he or they, as the case may be, is or are the *bonâ fide* owner or owners thereof, and that the same has been in his or their possession at least six months prior to the trial, and shall produce its rate of going antecedently, if required.

5. No chronometer maker or firm shall be eligible to take either of the above Prizes unless the instrument obtaining it becomes the property of the Government by purchase.

6. If the instrument obtaining the First Prize be the property of a firm, the name of the partner (who must have been such at the time of depositing the instrument and until the results of the trials have been declared) to whom the Freedom is to be awarded shall be submitted to and approved by the Court of Assistants.

7. If the person entitled to the First Prize be already a Freeman of the Company, the Court of Assistants may, if they think fit, award a Certificate of Merit, or such other addition to the Prize, in lieu of the Freedom, as may seem to them desirable, on due consideration of the special circumstances of the case.

8. No Chronometer Maker having obtained a First-class Prize, together with the Freedom of the Company, shall be eligible to obtain a similar award, but that circumstance shall not affect his right to compete for the Second-class Prize in subsequent trials; neither shall the holder of the Second-class Prize be debarred from competing for the superior Prize and Freedom in future years.

9. Any contravention of the Rules settled by the Company or the Astronomer Royal for regulating the competition will render the award of either Prize null and void.

10. Any competitor for the foregoing Prizes must be *bonâ fide* engaged in and carrying on the business of either a Chronometer, Clock, or Watch Maker.

11. Chronometer Makers desirous of competing for the above Prizes must send their names and addresses, and a statement of how many instruments they intend to deposit on trial, with the distinguishing number of each, to the Clerk of the Company, at Guildhall, at least one week before the commencement of the annual trials. Each successful competitor shall make and sign a declaration on the form supplied by the Clockmakers' Company, or to that effect.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(*Continued from page 100.*)

Tables for converting the Fine Contents of Bars of Gold and Silver reported in Milliemes into the English Trade Reports, and likewise for ascertaining the Fine Contents in dwts. and grains per ounce of the metal reported in Milliemes.

A.—Table for Gold-Contents.

Milliemes.	Carat Fine.	With reference to Standard.	Fine Contents in the pound troy.			Per Ounce.	
			Ozs.	Dwts.	Grs.	Dwts.	Grs.
1·000 =	24 =	Better 2 Carat =	12	0	0	20	0
·916$^2/_3$ =	22 =	Coin Standard =	11	0	0	18	8
·900 =	$21^{38}/_{64}$ =	*Worse* $0^{26}/_{64}$ Car. =	10	16	0	18	0
·800 =	$19^{12}/_{64}$ =	,, $2^{52}/_{64}$,, =	9	12	0	16	0
·700 =	$16^{51}/_{64}$ =	,, $5^{13}/_{64}$,, =	8	8	0	14	0
·600 =	$14^{25}/_{64}$ =	,, $7^{39}/_{64}$,, =	7	4	0	12	0
·500 =	12 =	,, 10 ,, =	6	0	0	10	0
·400 =	$9^{38}/_{64}$ =	,, $12^{26}/_{64}$,, =	4	16	0	8	0
·300 =	$7^{12}/_{64}$ =	,, $14^{52}/_{64}$,, =	3	12	0	6	0
·200 =	$4^{51}/_{64}$ =	,, $17^{13}/_{64}$,, =	2	8	0	4	0
·100 =	$2^{25}/_{64}$ =	,, $19^{39}/_{64}$,, =	1	4	0	2	0
·090 =	$2\ ^{9}/_{64}$ =	,, $19^{55}/_{64}$,, =	1	1	15	1	$19^1/_4$
·080 =	$1^{58}/_{64}$ =	,, $20\ ^{6}/_{64}$,, =	0	19	6	1	$14^1/_2$
·070 =	$1^{43}/_{64}$ =	,, $20^{21}/_{64}$,, =	0	16	18	1	$9^1/_2$
·060 =	$1^{27}/_{64}$ =	,, $20^{37}/_{64}$,, =	0	14	9	1	$4^3/_4$
·050 =	$1^{12}/_{64}$ =	,, $20^{52}/_{64}$,, =	0	12	0	1	0
·040 =	$0^{61}/_{64}$ =	,, $21\ ^{3}/_{64}$,, =	0	9	15	0	$19^1/_4$
·030 =	$0^{46}/_{64}$ =	,, $21^{18}/_{64}$,, =	0	7	6	0	$14^1/_2$
·020 =	$0^{30}/_{64}$ =	,, $21^{34}/_{64}$,, =	0	4	18	0	$9^1/_2$
·010 =	$0^{15}/_{64}$ =	,, $21^{49}/_{64}$,, =	0	2	9	0	$4^3/_4$
·009 =	$0^{13}/_{64}$ =	,, $21^{51}/_{64}$,, =	0	2	3	0	$4^1/_4$
·008 =	$0^{12}/_{64}$ =	,, $21^{52}/_{64}$,, =	0	1	21	0	$3^3/_4$
·007 =	$0^{10}/_{64}$ =	,, $21^{54}/_{64}$,, =	0	1	15	0	$3^1/_4$
·006 =	$0\ ^{9}/_{64}$ =	,, $21^{55}/_{64}$,, =	0	1	9	0	$2^3/_4$
·005 =	$0\ ^{7}/_{64}$ =	,, $21^{57}/_{64}$,, =	0	1	3	0	$2^1/_4$
·004 =	$0\ ^{6}/_{64}$ =	,, $21^{58}/_{64}$,, =	0	0	21	0	$1^3/_4$
·003 =	$0\ ^{4}/_{64}$ =	,, $21^{60}/_{64}$,, =	0	0	16	0	$1^1/_4$
·002 =	$0\ ^{3}/_{64}$ =	,, $21^{61}/_{64}$,, =	0	0	11	0	1
·001 =	$0\ ^{1}/_{64}$ =	,, $21^{63}/_{64}$,, =	0	0	6	0	$0^1/_2$

B.—Table for Silver-Contents.

Milliemes.	With reference to Standard.				Fine Contents in the pound troy.			Per Ounce.	
		Ozs.	Dwts.	Grs.	Ozs.	Dwts.	Grs.	Dwts.	Grs.
1·000 =	*Better*	0	18	0 =	12	0	0	20	0
·925 =	Coin Standard. =				11	2	0	18	12
·900 =	*Worse*	0	6	0 =	10	16	0	18	0
·800 =	,,	1	10	0 =	9	12	0	16	0
·700 =	,,	2	14	0 =	8	8	0	14	0
·600 =	,,	3	18	0 =	7	4	0	12	0
500 =	,,	5	2	0 =	6	0	0	10	0
·400 =	,,	6	6	0 =	4	16	0	8	0
·300 =	,,	7	10	0 =	3	12	0	6	0
·200 =	,,	8	14	0 =	2	8	0	4	0
·100 =	,,	9	18	0 =	1	4	0	2	0
·090 =	,,	10	0	9 =	1	1	15	1	$19^1/_4$
·080 =	,,	10	2	18 =	0	19	6	1	$14^1/_2$
·070 =	,,	10	5	6 =	0	16	18	1	$9^1/_2$
·060 =	,,	10	7	15 =	0	14	9	2	$4^3/_4$
·050 =	,,	10	10	0 =	0	12	0	1	0
·040 =	,,	10	12	9 =	0	9	15	0	$19^1/_4$
·030 =	,,	10	14	18 =	0	7	6	0	$14^1/_2$
·020 =	,,	10	17	6 =	0	4	18	0	$9^1/_2$
·010 =	,,	10	19	15 =	0	2	9	0	$4^3/_4$
·009 =	,,	10	19	21 =	0	2	3	0	$4^1/_4$
·008 =	,,	11	0	3 =	0	1	21	0	$3^3/_4$
·007 =	,,	11	0	9 =	0	1	15	0	$3^1/_4$
·006 =	,,	11	0	15 =	0	1	9	0	$2^3/_4$
·005 =	,,	11	0	21 =	0	1	3	0	$2^1/_4$
·004 =	,,	11	1	3 =	0	1	21	0	$1^3/_4$
·003 =	,,	11	1	8 =	0	0	16	0	$1^1/_4$
·002 =	,,	11	1	13 =	0	0	11	0	1
·001 =	,,	11	1	18 =	0	0	6	0	$0^1/_2$

Example of Calculation.

A bar of Precious Metal is reported to contain

·423 Fine Gold.
·357 Fine Silver.
·220 Alloy.
1000 parts of Metal.

Fine Gold.

·400 = 8 dwts. 0 grs. per Oz.
·020 = 0 ,, $9^1/_2$,, ,,
·003 = 0 ,, $1^1/_2$,, ,,
·423 = 8 ,, 11 ,, ,,

Fine Silver.

·300 = 6 dwts. 0 grs. per Oz.
·050 = 1 ,, 0 ,, ,,
·007 = 0 ,, $3^1/_4$,, ,,
·357 = 7 ,, $3^1/_4$,, ,,

The Alloy is not taken into Calculation.

(*To be Continued.*)

◆

New Evidence of the Earth's Rotation on its Axis

The observation has been made, that on railways which run to the north, or depart considerably from an easterly or westerly direction, the engine mostly leaps over the right or eastern line, or at least it presses against the line in that direction, and that this tendency of the engine to leave its course appears in proportion to its velocity, and inversely to the angle of departure to the East or West from the meridian.

This fact was noticed first on the Great Western of England, and next on the Hudson Line in America; and after attention had been drawn to it, it was confirmed by experience on other lines.

After seeking for the cause of this in the construction of the locomotive, meterological or magnetic influences, the phenomenon is traced to the earth's rotary motion from West to East, of which it is therefore, also a new evidence.

In harmony with this theory are the further observations, made on the shores of great rivers. It is a fact, that the rivers on the northern hemisphere, whose main course is northerly, overflow the eastern shore more than the western, and likewise that this holds good in rivers of the southern hemisphere, which flows from north to south.

The theory set up would lead to the inference, that rivers which run in an inverse direction would play more against the western shore; this inference is in conformity with experience.—From the *Allgemeines Journal der Uhrmacherkunst*. Tr.

◆

Queries and Replies.

Can any of your readers give me some method by which *Soft Solder* could be thoroughly cleaned off articles of jewellery, in cases where it is not possible to use the Scraper.—W. G. N. M.

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* That this fact demonstrates the Earth's rotation on its axis can be shown thus:—

The linear velocity of any point on its surface at the equator is at the rate of 1526 miles per second, and at either poles it is zero; hence, at any point between the equator and the pole it is inversely as the latitude. The direction of the motion is from West to East. Now, according to Newton's first law of motion, "every body continues in a state of uniform motion in a straight line to it." The measure of this tendency is given by the formula. $\frac{1}{2}MV^2$ At the equator, both the line and the train would have a parallel velocity, but as the train approaches a higher latitude the velocity of the former diminishes, while that of the latter remains approximately constant; hence, its energy, given in the formula, becomes an impressed force, acting towards the east. If **V** represents the linear velocity of the train, and **S** that of a point on the line (where the train is), in the direction of the earth's rotation, then the tendency to leave the line is given by the formula $\frac{1}{2}M(V^2 - 8^2)$. M being the mass of the train.

CORRESPONDENCE.

Half Chronometers.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—The *Swiss Horological Journal*, in speaking about the definition of "Half Chronometers," is evidently not aware of the understanding upon the point that prevails among the higher horological art in London. Nor need this be wondered at, when it is stated that in circles below that art, the name above mentioned is given to watches by a certain class of dealers, which watches seem, as far as horology is concerned, to have more affinity to the roasting-jack family than any other.

A "Half-Chronometer," then, is in reality a *full* chronometer in all parts *except the escapement*, that is to say, that it is more than "half," it is, in fact, two-thirds of an entire chronometer. For instance, it has a compensation balance, an isochronous spring, and a lever escapement; the "half"ing being completed by the adjustment and timing for position of the instrument. On the other hand, anything short of this between the ordinary lever and the chronometer pure and simple, must be given another name. Suppose that there is the isochronous spring wanting, but the compensation balance present, and the adjustment; then, our leading horologists would call that an "improved lever," to distinguish it from the ordinary lever.

It is now too late in the day to "play at boys" about the meaning of "Chronometer," at least, so far as horologists are concerned. We take exception to the explanation of the Swiss writer to the effect that "in the present day, it is sufficiently correct to call an instrument, having obtained a rating certificate from an Observatory, a chronometer. A half chronometer is an instrument furnished with a compensation balance, but which has not been adjusted to temperature." Such a definition will not do for scientific horology at all. In England there are many first-class chronometers that have never been in any observatory whatever; yet they are none the less chronometers for all that. A chronometer, in the universal acceptance of all horologists, whether scientific or practical, or both, is held to be a timekeeper having the detent escapement, without any exceptions whatever as to the nature of either the balance, or balance-spring. In practice, however, the spring is always cylindrical, and the balance compensated. Name-twisting and word-twisting in serious conversation has always been contemptible to men who love their art, whatever that art may be. Let it be supposed that I were to stick pins into a candle along every five inches of its length, and set it alight, and that I filled a tub with water, bored a hole in the bottom, and set the water running. What would be thought of me, if, in sober earnest, I showed them to my friends as a pair of chronometers? Yet, some people, who think that they are so *very logical*, would insist that my penny dip and old butter tub were both *Chronometers*, because they were *Chrono-Metrous*-time measurers. Surely such nonsensical twaddle ought to be mercilessly "shooshed" out of all horological common-sense hearing.

C. S. Murray.

Acknowledgment.

TO THE PROPRIETOR & EDITOR OF THE "WATCHMAKER, JEWELLER & SILVERSMITH."

Sirs,—It affords me great pleasure to testify to the efficacy of your Journal as an Advertising Medium, having from my advertisement concerning the "New India Rubber Watch Protector," in last month's issue, received above 500 applications from all parts of Great Britain for samples, and numerous orders for various quantities, establishing the proof that the advertising of a good article, through a good medium, gives good results.

Respectfully yours,

Hull, *March 28th*, 1883. Herman Bush.

"The Largest Pearl in the World."

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—I am rather surprised at your copying the paragraph from the *Pacific* without a comment, as it is very misleading. Such a pearl as the one described would not be "the largest in the world," as a much larger one has recently been sold. I believe there is one in Mr. E. W. Streeter's collection (lately the property of a distinguished lady of title), which is over an inch in its shortest diameter. I fear, too, that one's idea of "the size of a lemon" would be very greatly in excess of "one inch by three quarters;" one might almost say, that lemons of that size would be as rarely seen here as pearls. And, further, the pearl "taking several minutes to extract," points at once to the great probability that it was only *baroque*.

As to the pearl productiveness of the Coasts of California, I might say, that many have tried to work the fishings of these banks successfully; but up to the present, all, or nearly all, have been lamentable failures.

Yours, &c.,
W. I. Abbott.

Keyless Mechanism.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—As a maker of keyless mechanism, I write to protest against the incorrect statements of Mr. Whittaker, as to the manner in which a first-class watch is got up. No respectable manufacturer, after receiving an order to supply the best work that could be made in London, would use a movement with winding work attached at the price put down in the list. He would have it done in Clerkenwell, and pay more than double for it.

I trust that you will insert this letter in the interests of the few good workmen who are able to do this class of work.

A Clerkenwell Workman.

[The article arrived too late for revision; of course, we endorse our correspondent's remarks.—Ed.]

Silver Assay with Testing Tube.—Place in the tube enough of the pulverized mineral to fill one inch of the space, and on this pour nitric acid in quantity to occupy 2 inches more, and hold the mixture over a flame until the acid boils. The acid will dissolve whatever silver may be present, and must be passed through filtering paper to remove extraneous matter, and returned to the tube. Next add a few drops of water saturated with salt; any silver or lead that may be present will be precipitated in a cloudy form to the bottom. Drain off the acid, place the precipitate in the sunlight, and in a few minutes, if it contains silver, it will turn to a purple colour, and may be again liquefied by the addition of spirits of ammonia. The testing tube is formed of thin glass, about 5 inches long, and less than 1 inch diameter; bottom and sides of equal thickness. Where the tube is lacking, a cup may be used instead.

John Harrison, the Chronometer Maker.

(Concluded from page 115.)

IT was not until March 12th, 1761, that he received orders for his son William to proceed to Portsmouth, and go on board the "Dorsetshire" man-of-war, to proceed to Jamaica. But another tedious delay occurred. The ship was ordered elsewhere, and William Harrison, after remaining five months at Portsmouth, returned to London. By this time John Harrison has finished his *fourth* timepiece—the small one—in the form of a watch. At length William Harrison set sail with this timekeeper from Portsmouth for Jamaica in the "Deptford" man-of-war, on November 18th, 1761, and returned to England on March 26th, 1762. On the arrival of the ship at Port Royal the timekeeper was found to be only five and one-tenth seconds in error, and during the voyage of over four months, on its return to Portsmouth in the "Merlin," it had only erred one minute fifty-four and a half seconds. In the latitude of Portsmouth this only amounted to eighteen geographical miles, whereas the Act required that it should only come within the distance of thirty miles or minutes of a great circle. One would have thought that Harrison was now clearly entitled to his reward of £20,000.

But the delays interposed by Government are long and tedious. Harrison had accomplished more than was requisite to obtain the highest reward. It was necessary for him to petition Parliament on the subject. Three reigns had passed: Anne had died; George I. and George II. had reigned and died; and now in the reign of George III. an Act was passed enabling Harrison to obtain the sum of £5,000 immediately as part of the reward. But the Commissioners differed about the tempering of the springs. They required a second trial of the timekeeper. Two more years passed, and Harrison's son again departed with the instrument on board the "Tartar" for Barbadoes on March 28th, 1764. He returned in about four months, during which time the instrument enabled the latitude to be ascertained within *ten* miles, or *one-third* the required geographical distance.

Harrison memorialised the Board again and again. In the following September they virtually recognised his claims by paying him on account £1000. In February, 1765, the Board entered a minute on their proceedings that they were "unanimously of opinion that the said [Harrison's] timekeeper has kept its time with sufficient correctness, without losing its longitude in the voyage from Portsmouth to Barbadoes beyond the nearest limit required by the Act of 12th of Queen Anne, but even considerably within the same." They would not give him the necessary certificate, though they were of opinion that he was entitled to be paid the full reward.

Harrison was now becoming old and feeble. He had attained the age of seventy-four. He had spent forty long years in working at the chronometers. He was losing his eyesight, and could not afford to wait much longer.

> Full little knowest thou, who hast not tried,
> What hell it is in suing long to bide;
> To lose good days, that might be better spent;
> To waste long nights in pensive discontent;
> To spend to-day, to be put back to-morrow,
> To feed on hope, to pine with fear and sorrow.

But Harrison had not lost his spirit. On May 30th, 1765, he addressed another remonstrance to the Board, containing much stronger language than he had up to this time used. "I cannot help thinking," he said, "but I am extremely ill-used by gentlemen who I might have expected a different treatment from; for if the Act of the 12th of Queen Anne be deficient, why have I so long been encouraged under it, in order to bring my invention to perfection? And, after the completion, why was my son sent twice to the West Indies? Had it been said to my son, when he received the last instruction, 'There will, in case you succeed, be a new Act on your return, in order to lay you under new restrictions, which were not thought of in the Act of the 12th of Queen Anne'—I say, had this been the case, I might have expected some such treatment as I now meet with.

"It must be owned that my case is very hard; but I hope I am the first, and for my country's sake I hope I shall be the last, that suffers by pinning my faith upon an English Act of Parliament. Had I received my just reward—for certainly it may be so called after forty years' close application of the talent which it has pleased God to give me—then my invention would have taken the course which all improvements in this world do; that is, I must have instructed workmen in its principles and execution, which I should have been glad of an opportunity of doing. But how widely this is different from what is now proposed, viz., for me to instruct people that I know nothing of, and such as may know nothing of mechanics; and, if I do not make them understand to their satisfaction, I may then have nothing!

"Hard fate indeed to me, but still harder to the world, which may be deprived of this my invention, which must be the case, except by my open and free manner in describing all the principles of it to gentlemen and noblemen who almost at all times have had free recourse to my instruments. And if any of these workmen have been so ingenious as to have got my invention, how far you may please to reward them for their piracy must be left for you to determine; and I must set myself down in old age, and thank God I can be more easy in that I have the conquest, and though I have no reward, than if I had come short of the matter and by some delusion had the reward!"

The Right Honourable the Earl of Egmont was in the chair of the Board of Longitude on the day when this letter was read—June 13th, 1765. The Commissioners were somewhat startled by the tone which the inventor had taken. Indeed, they were rather angry. But Mr. Harrison, who was in waiting, was called in. After some rather hot speaking, and after a proposal was made to Harrison which he said he would decline to accede to "so long as a drop of English blood remained in his body," he left the room. Matters were at length duly arranged. Another Act of Parliament was passed, appointing the payment of the whole reward of £20,000 to the inventor; one moiety upon discovering the principles of the construction of his chronometers and assigning his four chronometers (one of which was styled a watch) to the use of the public, and the remaining moiety on sufficient proof of the correctness of the chronometers.

Mr. Harrison, accordingly, made over to the Commissioners of Longitude his various timekeepers, and deposited in their hands correct drawings, so that other skilful makers might construct similar chronometers on the same principles. Harrison expressed the greatest readiness to explain his inventions, and to subject them to every required test. Indeed, there was no difficulty in making the chronometers, after the explanations and drawings which Harrison had published. An exact copy of his last watch was made by the ingenious Mr. Kendal, one of Harrison's apprentices. This chronometer was used by Captain Cook during his three years' circumnavigation of the globe, and was found to answer as well as the original. This, as well as Harrison's chronometer, is still to be seen at the Royal Observatory, and both are in a good going condition. *

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* Kendal's "Chronometer," or large silver watch, was on view at the Loan Exhibition of Scientific Instruments held at South Kensington in 1876, and is now at the Royal United Service Institution. [ED.]

Although Harrison did not obtain the remaining moiety of his reward until 1767, two years after the above-mentioned meeting of the Board, his labours were over, his victory was secured, his prize was won. Notwithstanding his delicacy of health he lived a few years longer. He died in 1776, at his house in Red Lion Square, in his eighty-third year. It may be said of John Harrison, that by the invention of his chronometer he conferred an incalculable benefit on science and navigation, and established his claim to be regarded as one of the greatest benefactors of mankind.

Erratum.—Page 114, line 16, read "curb" for "kirb."

◆

Indian Silver Plate,

And the Causes of its Exclusion from the British Market.

Forwarded by E. J. Watherston.

Free Trade is the motto and boast of England; but it is not sufficiently known that the silver plate trade is "protected" in this country to such a degree that English silversmiths have a monopoly. The proof of this statement can be seen in the fact that no foreign manufactured silver plate is offered for sale by any London silversmith.

The exclusion of all foreign silver plate is caused by—

1st. The duty of eighteen pence per ounce.

2nd. The law that, *after* payment of the duty, all silver plate intended for sale must be sent to the Goldsmiths' Hall to be "assayed and stamped." This process involves what is technically known as "the scrape and parting assay," by which is implied, that not only every piece of plate, but every *part* of a piece—foot, handle, knob, spout, &c., must be scraped. The laws directing this procedure are upheld on the ground that they protect the Revenue; but the effect on highly finished plate is to damage it irreparably, and render it unsaleable. To obviate this damage the *English* manufacturer sends his plate to the Goldsmiths' Hall in the "rough" or unfinished state, and *after* it has been assayed and stamped, returns it into the hands of the workman, who finishes it. It is in this latter stage that the engraving, chasing, and general artistic skill is applied.

This course of procedure is obviously not open to the foreign manufacturer, except at prohibitive cost.

3rd. The law directs that if the plate be found by the Goldsmiths' Hall Assayers to be "under standard," it is to be broken up. The loss occasioned thereby falls on the manufacturer, but the *amount* of loss sustained by the breakage of the English "rough" plate is small in comparison with the loss on the foreign "finished" article.

By these laws and regulations silver plate of foreign manufacture is kept out of the English market as completely as if its importation were prohibited, while English silver plate is admitted into India free of duty and subject to no restrictions.

It is well known that India excels in the manufacture of silver plate. Specimens of this *illegal article of merchandise*, manufactured by Messrs. P. Orr & Sons, of Madras, are now on show at Messrs. Watherston & Son's, 12, Pall Mall East, and an appeal is made to England's love of justice to grant to India the benefits of "Free Trade in Silver Plate."

◆

Soldering Tortoise Shell.—Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each; then secure them in a piece of paper, and place them between hot irons or pincers; apply pressure and then cool. The heat must not be so great as to *burn* the shell, therefore, try it first on a white piece of paper.

Government Directions for Packing Chronometers

Sent from Abroad or from the Outports to the Royal Observatory at Greenwich.

Chronometers being very liable to injury in transit, the following precautions in sending them are to be adopted:—

I. Take the brass case containing the chronometer out of its jimbals, unscrew the glass case, and remove the chronometer from its brass case. Secure the balance with two thin wedges of cork placed near to the cross bar, between the balance and the plate, so as to prevent any movement of the balance. Replace the chronometer in the brass case, screw on its glass face, but do not put it again in its jimbals. Take out the screws which fix the jimbal ring to the wood box; wrap the screws with their circular brass nuts (if any) in paper, and lay the packet at the bottom of the wood box. Place a little stuffing (such as dry oakum, free from dust, or dry paper shavings free from dust, or any other dry, clean, and soft material; wood shavings being sometimes objectionable as bringing turpentine and dirt) on the packet; lay the jimbal ring upon the stuffing, seeing that the screws and nuts (if any) in the jimbal ring used for fixing the chronometer to the ring, are screwed home. Place on the jimbal ring some more stuffing, then lay in the brass case containing the chronometer, first wrapping a sheet of thin paper round it to prevent contact with the stuffing material. Fill the space between the brass case and wood box with stuffing, around the brass case, below it, and above it, up to the glass lid of the wood box.

II. Having closed the wooden chronometer box, it is to be placed in a wicker basket or hamper, or in a box of partially yielding character, and is to be packed therein with abundance of soft stuffing. If there is no wicker basket at hand, or nothing except a wooden box, this box must be surrounded with a large quantity of stuffing and enclosed in canvas, so that it can never receive a jarring blow. It is of the greatest importance that the outside of the packing case be soft and yielding. When a wooden box is used, the lid of the box should be fixed by screws.

III. Two or more chronometers (secured from injury in their boxes as explained in I.) may be packed in a yielding case or basket, but all contact between them must be prevented by the use of straw or some stuffing material (as mentioned in II).

IV. * * * * Send by a mail or passenger train, but never by a luggage train.

[The above directions, issued several years ago, appear to ignore the existence of the outer case of a chronometer, and are too troublesome for ordinary business purposes. A simple and safe method of preparing one for a short journey by rail, is to fix a number of cork wedges between the brass box and jimbal ring. It would be a great convenience to manufacturers if the railway companies would make arrangements to prevent the risk of a circular motion being given to the instruments while in course of transit, as the necessity of stopping them would then be obviated.—Ed.]

◆

To Whiten Silver Watch Dials.—Flatten a piece of charcoal by rubbing it on a flat stone; on this place the dial, face upward; apply a gentle heat carefully with a blowpipe, allowing the flame to play all over the surface of the dial without touching it, so as to thoroughly heat without warping the dial. Then pickle and rinse, using acid enough to make the water very tart, and immersing but for a few seconds. Silver dials may also be annealed by heating them red hot on a flat piece of copper over a clear fire.

Trade Notes.

An esteemed correspondent writes as follows:—"I think it probable that Mr. Whittaker is right in maintaining that a machine-made going barrel watch will be the watch *for the million,* and English watchmakers might do well to be prepared for such a result. As to fine watches, I cannot see that the Americans have yet come seriously into competition with us. I was asked a higher price for a first-class American watch than I paid for a most beautiful one made by the late Charles Frodsham. On the other hand, I have a fine large going barrel gold watch made in Germany, which cost less than one third of the Frodsham; and English watchmakers must be prepared to compete with such watches as this. I know the Continent rather well as a tourist, and I must confess that I do feel some misgivings as to our ability to compete with the Swiss at cheap watchmaking, but I cannot see any reason why we should be beaten by the Americans."

The *Allgemeines Journal der Uhrmacherkunst* reports an amusing event from Vilag, Denmark. According to this the watchmakers agreed to stop every clock in their windows, and to set them to 12 a.m., or zero. The object was to force the town authorities to provide public clocks, and they appear to have gained some success to this effect, for a commissioner was appointed to enquire into the matter.

A New York Correspondent writes as follows:—"March 17th. Business generally in the United States is not in a very flourishing condition, owing to a variety of causes, but at the same time I think the country is in a very sound and healthy state generally, and there is nothing to fear as to the future."

A large new clock has just been erected in Roby Church, near Liverpool, by Messrs. John Smith & Sons, Midland Clock Works, Derby. It shews time on two 5ft. 6in. dials, and strikes the hours upon a 15 cwt. bell.

Index to Antique Rings and Ornaments.

78—Tower ring from the Londesborough collection.

79—Represents a specimen from the Londesborough collection. It is of gold, and was found in the Thames, with the inscription "Sans-Vilinie" upon it.

80—In Bromsgrove Church, Staffordshire, are the fine monumental effigies of Sir Humphrey Stafford and his wife (1450), remarkable alike for the rich armour of the Knight and the courtly costume of the lady.

81—A weighty ring of fine gold, found in 1823 at Thetford, in Suffolk.

82—A ring formed of cheap mixed metal, found in London and presented to the Londesborough collection by Mr. Roach Smith.

83—Gold Tower ring, of the most elaborate design, with the inscription "Joy be with you," in letters on the curve of the ring.

84—A thick gold hoop, with an abbreviated motto, "In . God . is . a . r," which the late Mr. Crofton Croker thought might probably mean "In God is a remedy."

The New United States Tariffs.

The following extracts from the New Tariff Bill, just passed by the U. S. Congress, will doubtless interest our readers.

Chronometers, box or ship's, and parts thereof, 10 per cent. ad valorem; no change.

Clocks, and parts of clocks, 30 per cent. ad valorem; a slight change; the present tariff being 33 per cent.

Watches, watch cases, watch movements, parts of watches, and watch materials, not specially enumerated or provided for in this Act, 25 per cent. ad valorem; no change.

Jewellery of all kinds, 25 per cent. ad valorem.—In the present tariff there are many discriminations and grades of duty. The new law lumps all under a 25 per cent. duty, and simplifies the schedule without any marked change in the tax.

Philosophical apparatus and instruments, 35 per cent. ad valorem. Present tariff, 40 per cent., a reduction of 5 per cent.

Precious stones of all kinds, 10 per cent. ad valorem. Present tariff, not set, 20 per cent. ad valorem; set, 25 per cent., this being a considerable reduction.

Silver Plate. 45 per cent. ad valorem. During the time the Tariff Bill was being discussed in the senate, the duty on watches was raised from 25 to 40 per cent., but as the house did not concur, the whole bill was referred to a Conference Committee, and the bill, as drawn up by them, was passed in both houses at nearly the closing hour of the session.

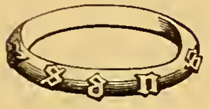
Trade Recipes.

To Separate Gold from Silver.—The alloy is to be melted and poured from a height into a vessel of cold water, to which a rotary motion is imparted. By this means the alloy is reduced to a finely granular condition. The metallic substance is then treated with nitric acid, and gently heated. Nitrate of silver is produced, which can be reduced by any of the ordinary methods; while metallic gold remains as a black mud, which must be washed and melted.

Moulding Sand for Brass or Iron.—The various kinds of good moulding sand employed for casting iron or brass have been found to be almost uniform in chemical composition, varying in grain or the aggregate form only. It contains between 93 and 96 parts silex, or grains of sand, and from 4 to 6 parts clay, and a little oxide of iron, in each 100 parts. Moulding sand which contains lime, magnesia and other oxides of metals, is not applicable, particularly for the casting of iron or brass. Such sand is either too close, will not stand or retain its form, or will permit the metal to boil through its closeness.

To Bronze Polished Steel.—Methylated spirits, 1 pint; gum shellac, 4 oz.; gum benzoine, ½ oz. Set the bottle in a warm place, with occasional agitation. When dissolved, decant the clear part for fine work, and strain the dregs through muslin. Now take 4 oz. powdered bronze green, varying the colour with yellow ochre, red ochre, and lamp black, as may be desired. Mix the bronze powder with the above varnish in quantities to suit, and apply to the work, after previously cleansing and warming the articles, giving them a second coat and touching off with gold powder, if required, previous to varnishing.

ANTIQUE ✠ RINGS ✠ & ✠ ORNAMENTS.



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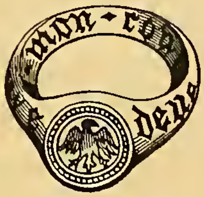

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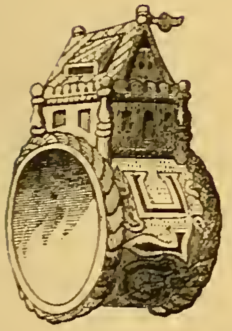

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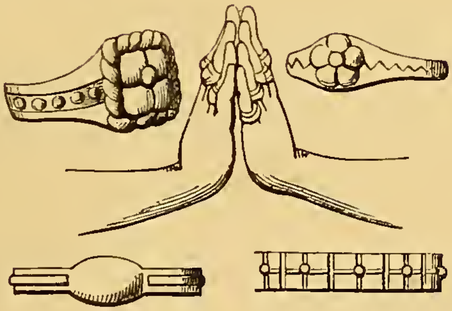

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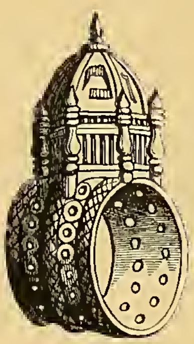

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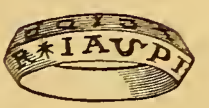

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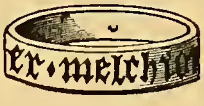


84.

For Description, see page 128.

Bronzes.

By C. D. E. Fortnum, F.S.A.

(Concluded from page 101.)

"Il Frammingo," François Duquesnoy, was a native of Brussels (1594-1644) and an artist of great ability. He is particularly excellent in his representation of children, and for the admirable delicacy and softness that he imparted to the flesh. Some figures after his models were produced in bronze, as the well-known fountain, the "nanneken-pis," at Brussels. His works in ivory are renowned, and he executed some large statues in marble, as the St. Andrew in St. Peter's at Rome. John Michael Bysbrack, born in Antwerp, 1693, came to England, and, among other works, made an equestrian statue to William III., which is now at Bristol. He died in 1770. The lion, until lately so conspicuous an object on Northumberland House, was cast (some say, but it is doubtful) by Laurent Delvaux, who made a Venus in bronze, after the antique, now at Holkham. He worked in England about the middle of the last century.

Sculpture in the low countries at this period was quite equal in execution to that of the rest of Europe, maintaining her influence, but partaking, at the same time, of all the meretricious manner of the period, and indulging in it to the full extent. Arthur Quellinus, of Antwerp, a pupil of Frammingo, had certainly a feeling for art superior to the extreme manner of his day, and did important work in the town hall at Amsterdam and elsewhere. We do not know of works by him in bronze. Excellent ornamental metal-work in bronze and brass was produced in the Netherlands, &c., during the last century, the style being for the most part modified by French taste in design and ornamentation. We have not space to enter into particulars, nor may we refer individually to works in statuary of more recent date, many of which are of great excellence.

Our information in respect of the native metal-workers of Spain is very indefinite, and the sculpture of that country has yet to be accurately investigated and its history written. Much valuable information is scattered here and there in various works, but more remains to be learnt.

After the Roman power, which extended so largely in Spain, had declined, we know little of what prevailed in the peninsula, or may have preceded the Saracenic occupation of the country, by which Arabian architecture became predominant in its southern portion. Other influences had also worked in various districts, and from a very early period. Her commerce with Phœnicia in the exportation of tin, copper, &c., and the existence of Punic settlements upon the coasts of Spain, would leave some mark, less distinct, perhaps, than that of Grecian, and subsequently of Roman art; these again to be succeeded by that of Byzantium. Personal ornaments, &c., in the style known as Merovingian are also found in Spain. The earlier Arabian or Saracenic rule was followed by that of the Moors, during which the potter's art was so successfully practised. Throughout each and all of these periods there can be little doubt that admirable work in bronze and other metals was executed in Spain, influenced probably by the imigrant rather than the native artificers.

The fifteenth century saw Flemish and Italian *renaissance* as the predominant style, executed for the most part by Flemish artists, while from Germany a taste was introduced for carved, gilt, and coloured altar-pieces: some of these, modelled with Spanish sentiment and gorgeous colour, produce a startling if not a satisfactory effect upon an eye educated in a purer school.

Enormous wealth had flowed into the country where, moreover, the church was all-powerful. Architecture and the sister-arts were abundantly encouraged, perhaps no more so than that of the gold and silver-smith. But here again we find that the most important workers in those materials were the members of a German family named Arphe or Orfe; the first recorded of whom, Enrique de Arfe, settled in Leon about 1470.

The latter end of the fifteenth and early sixteenth century also saw Italian taste exercising a leading influence, and Italian artists working in and for Spain. Leon Leoni undertook commissions, and his son Pompeo passed some years in that country. Some native Spanish sculptors had perfected their art in Italy, during the preceding or early part of that century, among whom Alonzo Berrugnete is famous for his works in the cathedral of Toledo, &c. Again, we hear of those by Esteban Jordan; of Juan de Juni; of Hernandez; of Alonzo Cano (1601-1667); of Martinez Montanez; and of Pedro Roldan (1664-1700); Spanish sculptors; all of whom worked, more or less, in the Italian manner, but with a Spanish sentiment, and, by the artists of later time, not without exaggeration in attitude and expression.

Of purely Spanish works in bronze of the fifteenth and sixteenth centuries we know very little. Doubtless some were produced of the smaller kind, but it is more probable that the productions of Flanders and the artistic bronzes of Italy supplied the demand from that class of society which was surrounded by luxury and splendour. Admirable arms, plate, and jewellery were wrought by Spanish hands, and the kindred art of the bronzist was surely not unknown, although it seems to have taken a secondary position, and its history is as yet obscure.

Of later time we have on either side of the high-altar, in the cathedral of Santiago, pulpits richly adorned with reliefs and ornaments in bronze, the work of Juan Bautista Celma, about 1600. The great candelabrum known as "el tenebraïgo" in the Cathedral at Seville was the work of Bartolomé Morel, who also cast the large figure of Faith that surmounts the Giralda tower, and acts as a vane. Costly and overloaded ornaments and vessels of gilded metal in the most exaggerated *rococo* taste are met with in Spanish churches, &c., but long continued wars following upon the French revolution and an unsettled state of Government and of society since, retarding the progress of commerce and of the industrial and finer arts, have left that noble country sadly behind her European sisters.

◆

Pinion Diameter.—The following are excellent rules for determiming the correct diameter of the pinion by measuring teeth of the wheel that seizes into it. The term *full*, used below, indicates full measure from outside to outside of the teeth named, and the term *centre*, the measure from the centre of one tooth to the centre of the other tooth named, inclusive. For diameter of a pinion of 15 leaves measure, with calipers, a shade less than 6 teeth of the wheel, full. For diameter of a pinion of 14 leaves measure, with calipers, a shade less than 6 teeth of the wheel, centre. For diameter of a pinion of 12 leaves measure, with calipers, 5 teeth of the wheel, centre. For diameter of a pinion of 10 leaves measure, with calipers, 4 teeth of the wheel, full. For diaeter of a pinion of 9 leaves measure, with calipers, a little less than 4 teeth of the wheel, full. For diameter of a pinion of 8 leaves measure, with calipers, a little less than 4 teeth of the wheel, centre. For diameter of a pinion of 7 leaves measure, with calipers, a little less than 3 teeth of the wheel, full. For diameter of a pinion of 6 leaves measure, with calipers, 3 teeth of the wheel, centre. For diameter of a pinion of 5 leaves measure, with calipers, 3 teeth of the wheel, centre. As a general rule, pinions that lead, as in the hour wheel, should be somewhat larger than those that drive, and pinions of clocks should generally be somewhat larger proportionally than those of watches.

£10 REWARD.—STOLEN

On March 24th, 1883, from a Watchmaker's shop in Liverpool, which was entered, the following property, viz.:—

Watch—A lady's damaged 18 carat gold Geneva watch, gold dial, No. 5081
Watch—A lady's ditto, No. 3734
Watch—A lady's 18 carat gold watch, enamelled Cupid, No. 9075.
Watch—A lady's 18 carat gold watch, open face, gold dial, girl looking into a brook.
Watch—A small 18 carat gold watch, thin case, No. 9904
Watch—A large sized silver Waltham watch, railway bezel, 2oz. case, open face, gold hands, No. 1,872,050
Watch—A ditto, No. 1,895,905
Watch—A ditto, No. 1,895,904
Watch—A Waltham hunter watch, white dial, gold hands, No. 1,895,947
Watch—A ditto, No. 1,895,903 or 5
Watch—An 18 carat gold open face keyless watch, No. 94,959
Watch—A small demi-hunter silver Geneva watch, engraved, No. 29,919
Watch—An open face centre seconds Geneva watch, steel hands, No. 25,600
Watch—A silver Geneva centre seconds watch, open face, No. 25,507
Watch—A small open face, keyless silver Geneva watch, flat
Watch—A ditto, No. $\frac{8175}{40}$ [glass, No. 505
Watch—A demi-hunter Watch, silver dial, No. 39,196
Watch—An open face ditto, No. 3858
Watch—A large Geneva silver hunter watch, No. 29,630
Watch—A large silver open face Geneva watch, No. 24,941
Watch—A ditto, No. 7334
Watch—A silver Geneva hunter watch, No. 3596
Watch—A ditto, No. 3594
Watch—An open face silver Geneva watch, No. 5787
Watch—A ditto, No. 721
Watch—A small silver keyless sight hunter watch, enamelled as platinum, gold button, white dial, No. 95,695
Watches—2 silver Geneva lever watches, open faces, flat glasses, No. of one 34,536
Watch—An open face metal Geneva watch. No. 61,250
Watch—A small gold Geneva watch, No. 12,798
Watch—A silved open face lever watch, makers, Adams & Co., Liverpool, No. 7916
Watch—A ditto, maker, Husband, Evesham, No. 19,026
Watch—A small open face gold Geneva watch, No. 2066
Watch—A silver Geneva watch, No. 23,374
Watch—A metal Geneva watch, No. 9815
Watch—An 18 carat, open face, gold keyless Geneva watch, No. 32,288
Watch—An open face silver centre seconds watch, No. 10,507
Watch—A silver Geneva watch, flat glass, No. 68,017
Watch—A silver lever watch, maker, French, Liverpool, No. 5878
Watch—A silver lever hunter watch, maker, A. Samuel, Liverpool, No. 13,650
Watch—A gold $\frac{3}{4}$-plate lever watch, maker, H. Foster, Liverpool, No. 6578
Watch—A silver lever watch, maker, T. Dent, London, No. 1098
Watch—A gold $\frac{3}{4}$-plate open face lever watch, gold dial, maker, J. Brownbill, Liverpool, No. 140
Watch—A silver Geneva watch, centre seconds, open face, No. 12,121
Watch—A metal Geneva hunter watch, No. 619
Watch--A small open face silver Geneva watch
Watch—A silver Geneva hunter watch, No. 1445
Watch—A metal verge watch, No. 9831
Watch—A silver lever watch, maker, Lewis Wolfson, Liverpool, No. 30,317
Watch—A silver Geneva hunter watch, G f f $\frac{55}{4}$
Lockets—5 small coloured gold lockets
Locket—1 large coloured gold locket, with black enamelled letters T. M. O.
Locket—1 ditto, flat sides with hard round edge
Lockets—13 bright gold lockets, various patterns, and 3 silver ditto
Breast pins—12 breast pins, bright and coloured gold
Breast pins—10 silver breast pins
Screws—3 sets of coloured gold screws
Studs—2 coloured gold collar studs
Studs—1 plain gold stud, and 1 silver stud
Studs—1 set of cat's eye pearl studs, 1 set of coloured ball studs, and 1 set of flat studs
Links—$\frac{1}{2}$ dozen engraved and plain silver links
Ear-rings—3 pairs of coloured gold ear-rings, 2 Japanese pattern, 1 plain balls with knot tied
Ring—1 diamond and ruby ring, set with 5 diamonds and 4 rubies, 18 carat gold
Ring—A diamond and sapphire ring, set with three sapphires and 3 diamonds
Rings—18 coloured gold gem rings
Rings—3 gold signet rings
Necklet—A coloured gold necklet, small pattern
Necklet—A ditto, small beaded pattern, open link
Thimbles—several silver thimbles
Brooch—A coloured gold brooch with turquoise stones
Brooch—A bright gold brooch with 4 garnet stones
Brooch—A bright gold brooch
Brooches—4 silver brooches, inlaid with pebble stones
Seal—A coloured gold seal, with emblem Faith, Hope, and Charity
Compass—A bright gold compass, with paper dial
Compass—A gold compass, with glass sides
Seal—A silver seal, dog's head and stone
Seal—A gold mounted seal, lotterie
Scarf Rings—2 bright gold horse-shoe scarf rings
Albert—A 15 carat gold long link albert, weight 2oz.
Albert—A 9 carat gold albert, 13dwt.
Albert—A 9 carat gold albert, weight 16dwt. [between
Albert—A 9 carat gold albert, long link and twisted coil
Albert—A 9 carat gold albert, entwined pattern
Albert—A 9 carat gold albert fancy pattern, with small stars cut in links
Albert—A silver albert, oval links
Albert—A silver albert, long plain link pattern
Guard—A long curb gard

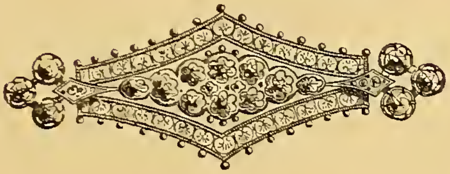
Pawnbrokers, Watchmakers, Jewellers, Second-Hand Dealers and Others are requested to examine their Stocks immediately, and if any portion of the above Stolen property is in their possession, or should after the delivery hereof be offered, to take such reasonable and proper steps as they may consider necessary to secure the detention of such property and of the person or persons offering the same, also to communicate the particulars forthwith to the undersigned.

A working Jeweller, named ROBERT SCHMIDT, a German, who Absconded on Sunday, the 25th inst., has been charged with the Robbery. He is about 30 years of age, 5ft. 6in. high, proportionate build, dark hair, thin, light brown whiskers parted on chin, moustache, thin face with scar on left cheek, consumptive appearance, two club feet turned in at toes, peculiar boots, dressed in dark overcoat, black frock coat, dark trousers and tall silk hat; had a satchel with strap over shoulder, and portmanteau. His father is a joiner in Bauern, Germany. As this man will no doubt pledge the property and endeavour to leave the country, it is requested that immediate inquiries be made at Pawnbrokers, Shipping Offices, also on board outward bound vessels, and if found arrest, or if traced telegraph to

Central Police Office, Liverpool. *March 28th*, 1883 GEORGE WILLIAMS, *Chief Superintendent.*

Supplement to the Watchmaker, Jeweller, and Silversmith, May 5th, 1883.

MONTHLY SUPPLEMENT OF DESIGNS.



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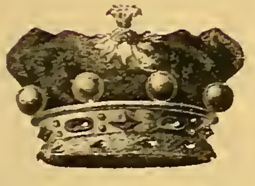
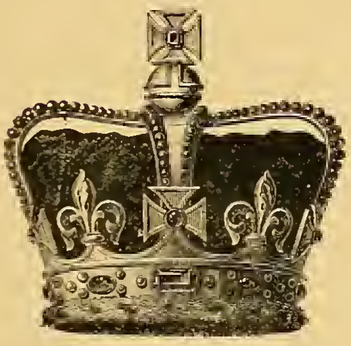
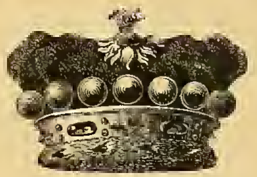


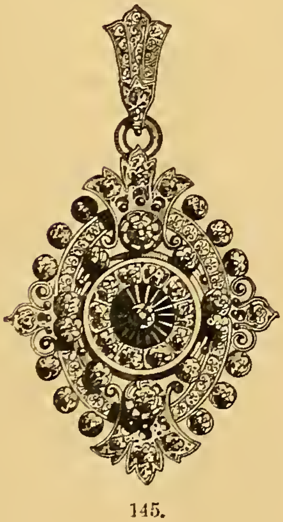
142. Baronet's Coronet.



143. Royal Crown II.



144. Viscount's Coronet.



145.

THE WATCHMAKER JEWELLER AND SILVERSMITH

EDITED BY JAMES U. POOLE.

Entered at Stationers' Hall. Registered for Transmission Abroad.

No. 96.—Vol. VIII.] MAY 5, 1883. [Subscription, 5s. per Annum. Post Free.

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ILLUSTRATED SUPPLEMENT:—Designs for Modern Jewellery.

Our Prize Competition.

AS previously intimated, a prize of £50 is offered for the best original Essay on Going-barrel Watches—both keyless and key-winders—which shall be best calculated to supply the demands of the market, and to enable English watch manufacturers, not only to withstand Foreign competition at home, but to extend their operations abroad.

The subject should be dealt with retrospectively and prospectively, and all suggestions must be both practical and practicable. In order to ensure the benefits arising out of the consideration of a variety of opinions, the proprietor reserves the right of first publication in these pages, but the copyright would remain the property of the author.

We are pleased to be able to announce that Messrs. V. Kullberg and J. Tripplin, have kindly consented to act as Judges; and at the request of the proprietor, we shall share their labours.

The Essays must be deposited at the Office of this Journal not later than July 10th, under cover, and each bearing a distinguishing mark or motto.

In the event of the Judges being of opinion that sufficient merit has not been manifested, the prize may be held over, or modified at their discretion.

With regard to the second series of Essays, it is a patent fact that machinery and the factory system must largely enter into the construction of the low-priced English watch of the future, and we have arranged, with the consent of the subscribers, that the subject shall be "Watch Tools and Machinery." In giving ample notice of this, we hope that our friends engaged in watch factories abroad will give us the benefit of their experience, as we wish to obtain the most recent information. These competitions are not invited for the purpose of occupying space in our columns, but for the ultimate good of the trade.

Continental Observatory Trials.

FROM the report of M. Gautier, Director of the Geneva Observatory, it would appear that 486 "chronometers" were deposited for trial during last year; but it is evident that the term "chronometer" is losing its horological significance, for only two are referred to as being marines, and of the 26 watches which came up to the standard entitling them to prizes or honourable mention, 25 have lever escapements; one, standing 19th on the list, is described as having a "spring" or "detent" escapement. A noteworthy feature in the report is that the names of the adjusters are published as well as those of the firms to whom the instruments belong, and it is only by the encouragement and recognition of personal merit that the horological art can be sustained at the present time, as the number of skilled workmen are steadily diminishing.

These trials are now inseparable from the manner in which the Swiss watch trade is conducted; but we see very little prospect of a similar system being established here, owing to the isolated manner in which manufacturers work. Discussions have frequently been held at the Horological Institute on the question, but individual jealousy has prevented any scheme from receiving general support.

The second trial we have to notice is that of the German Government at the Maritime Observatory of Hamburg, from 3rd October, 1881, to 1st April, 1882, at which only marine chronometers were tested.

We are informed in the report that the temperature ranged from *3·7° Centigrade (38 Fahr.) to 30·9 (87 Fahr.), and as the trial is conducted during the winter months, a longer period of natural cold is obtained than at our own—from January to July.

The temperature was varied 5° every ten days, and each chronometer was tested three times under the same conditions, thus dividing the period of 180 days into six different temperatures. During each day the difference between the maximum and minimum rarely exceeded 1°.

The rates were taken every other day at 10 a.m. by comparison with the standard clock at the Observatory, and in addition Dr. Schrader, the astronomer, made a second comparison every ten days between 10 and 11 a.m., independent of the first, and intended to control it.

Thirty-one chronometers were entered for competition, of which one was withdrawn.

The figures in the list strongly resemble those published in connection with our own trials, and it would be interesting to know the names of the adjusters and the makers of the balances, the construction of the first six being described as follows:—Check compensation, special construction; auxiliary compensation for cold; new auxiliary compensation for heat; auxiliary compensation; ditto, ordinary; ditto, with Airy's auxiliary compensation arm; and the trial numbers are 13·2, 20·2, 26·5, 29·3, 38·4, 39·7.

The first four chronometers have been purchased by the Imperial Admiralty at prices considerably higher than those now given by our own Government, viz.—£75, £60, and two at £50 each.

This is the 15th trial which has taken place, and Dr. Schrader states, that although there has been a falling off in the number of chronometers deposited, their excellence has surpassed any of those which have been previously tested.

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* To convert degrees Centigrade into degrees Fahrenheit, multiply by 9, divide by 5, and add 32.

To convert degrees Fahrenheit into degrees Centigrade, subtract 32, multiply the remainder by 5, and divide by 9.

Dent's Compensation Balances.

THE Chronometrical art appears to be so nearly approaching perfection that the labours of some of its founders are apt to be overlooked, and it is interesting to occasionally refresh our memories on the point. We publish the following description of the Collection of Balances exhibited at the Loan Exhibition of Scientific Instruments in 1876, by Messrs E. Dent & Co.

No. 1. An early form of balance.—Steel connexions are fastened near the root of the rims of a plain brass balance; the expansion or contraction of these being less than that of the central brass arm, the rims are by any change of temperature tilted towards or away from the axis of motion.

No. 2. An early form of balance.—Loops formed of brass melted on to steel are fastened upon each side of the axis of motion, in consequence of the greater expansion or contraction of the brass, these open or close with the change of temperature, and drag in or thrust out the small brass weights, to which they are attached by wires.

No. 3. An early form of balance.—The rims are of brass melted upon steel, the brass being outwards; with any change of temperature the rims open or close.

No. 4. An early form of balance.—A flat steel bar has soldered to its extremities underneath pieces of brass; the ends of the steel bar carry uprights bearing weights upon their summits; the brass pieces underneath having a different rate of expansion to the steel, bend it either upwards or downwards, and tilt the uprights carrying the weights towards or away from the axis of motion.

No. 5. A balance of similar design, but having brass melted upon the steel, instead of merely being soldered to its extremities.

No. 6. A balance of modern design, similar in its action to No. 5.

In order to obtain perfect compensation, it is found that for an increase of temperature the compensation weights must advance more rapidly towards the axis of motion, than for the same decrease of temperature they would recede from it. This peculiarity necessitates what is called secondary compensation. The following balances have been introduced to obviate this error:—

No. 7.—Compensation pieces formed of brass melted upon steel receive such curves, that with any increase of temperature the compensation weights move towards the axis of motion more directly than they recede from it with any decrease of temperature. (Dent's balance.)

No. 8. A compensation bar is formed, as in No. 5, by brass being melted upon steel, and this bending upwards or downwards, with any change of temperature, tilts the weights carried by the staples towards or away from the axis of motion. But the staples are themselves compensation pieces, and they lift the weights higher with any increase, and depress them with any decrease of temperature, and in this manner increase the rate at which they approach the axis of motion and diminish the rate at which they recede from it. (Dent's patent balance.)

No. 9. A balance of nearly the same form as No. 6, but the section of its rim is somewhat in the shape of a prism; the form of the rim offers less resistance to the motion of the compensation weight inward than outward. (Dent's registered balance.)

No. 10. A balance similar to No. 5 is mounted upon the arm of a balance similar to No. 6. With any increase of temperature, the first balance can assist the second, but with any decrease of temperature its motion is checked. The whole combination, therefore, is more effective in the heat than in the cold. (Glover's form.)

No. 11. An experimental balance, contrived for the purpose of removing weight from the centre, both with an increase and decrease of temperature. (Wetherill's form.)

No. 12. An auxiliary compensation is added to a balance similar in form to No 6. The auxiliary consists of two double compensation pieces, and the effect is to carry weight towards the axis of motion, both for an increase and decrease of temperature. The effect of the main compensation weights is therefore increased in the heat and diminished in the cold. (Dent's balance.)

No. 13. A balance of similar design to No. 8, but arranged so that the secondary compensation can be altered with greater facility. (Dent's balance.)

No. 14. A balance having the same general operation as No. 8, but the effect is obtained by straight bars only. The secondary compensation can also be altered without inconveniently disturbing the main compensation, and both without producing any great alteration in the time of the chronometer. (Dent's balance.)

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Approximate Conversion of the Monetary Units of the various Countries into English Currency.

Country.	Monetary Unit.	English Currency. s.	d.
Argentine Republic ..	Peso	3	11½
Austria	Florin . ..	1	8
Belgium	Franc	0	9⅝
Bolivia	Boliviano ..	3	3¾
Brazil	Milreis of 1000 reis	2	2¾
Canada	Dollar	4	1¼
Chili	Peso	3	8¾
Cuba	Peso	3	9¾
Denmark	Crown	1	1
Ecuador	Peso	3	3¾
Egypt	Piaster	0	2½
France	Franc	0	5⅝
Greece	Drathma ..	0	9⅝
German Empire	Marc	0	11 13/16
Hayti	Gourde	3	11½
India	Rupee of 16 Annas	1	7
Italy	Lira	0	9⅝
Japan	Yen	3	7
Liberia	Dollar	4	1¼
Mexico	Dollar	3	7¼
Netherland	Florin	1	8
Norway	Crown	1	1
Peru	Sol	3	3¾
Portugal	Milreis of 1000 reis	4	5¼
Russia	Rouble of 100 copeks	2	8
Sandwich Islands ..	Dollar	4	1¼
Spain	Peseta of 100 centim.	0	9⅝
Sweden	Crown	1	1
Switzerland	Franc	0	9⅝
Tripoli	Mahul of 20 piaster	2	11
Turkey	Piaster	0	2¼
United States of America	Dollar	4	1¼
United States of Columbia	Peso	3	3¾
Venezuela	Bolivar	0	9⅝

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Black Lead Crucibles.—Black lead crucibles arc made of two parts graphite and one part fire clay, mixed with water into a paste, pressed in moulds, and well dried, but not baked hard in the kiln. This compound forms excellent small or portable furnaces.

Guide to Calculate the Value of Gold and Silver after the various Assay Reports.

By H. Bush, Hull.

(*Continued from page* 124.)

As not only the divisions and designations of the Fine Contents of Gold and Silver are variable in different countries, so are also the weights used for Precious Metals. Whilst in Great Britain the oz., dwt., and grain, or decimal oz. weights are optional, the weights in the United States are solely oz., dwt., and grain. In France, Germany, and most of the European countries, the gram-weight is customary, one gram being equal to 15½ grains. The gram divides again in centigrams, or one-hundredth part of a gram. In Russia a weight called the Solotnik and Doli is used, one Solotnik has 96 Dolis; a Solotnik is equal to 2 dwts. 16 grains, and a Doli to ⅔ of a grain.

The following table will give approximate comparisons:—

Ozs. and Dwts.		Decimals.		Grams.		Solotnik.	Doli.
5 ozs.	=	5·000	=	155·50	=	37	48
4 ,,	=	4·000	=	124·40	=	30	0
3 ,,	=	3·000	=	93·30	=	22	48
2 ,,	=	2·000	=	62·20	=	15	0
1 ,,	=	1·000	=	31·10	=	7	48
19 dwts.	=	·950	=	29·55	=	7	12
18 ,,	=	·900	=	28·00	=	6	72
17 ,,	=	·850	=	26·44	=	6	36
16 ,,	=	·800	=	24·88	=	6	0
15 ,,	=	·750	=	23·32	=	5	60
14 ,,	=	·700	=	21·77	=	5	24
13 ,,	=	·650	=	20·21	=	4	84
12 ,,	=	·600	=	18·66	=	4	48
11 ,,	=	·550	=	17·10	=	4	12
10 ,,	=	·500	=	15·55	=	3	72
9 ,,	=	·450	=	14·00	=	3	36
8 ,,	=	·400	=	12·44	=	3	0
7 ,,	=	·350	=	10·88	=	2	60
6 ,,	=	·300	=	9·33	=	2	24
5 ,,	=	·250	=	7·77	=	1	84
4 ,,	=	·200	=	6·22	=	1	48
3 ,,	=	·150	=	4·66	=	1	12
2 ,,	=	·100	=	3·11	=	0	72
1 ,,	=	·050	=	1·55	=	0	36

Grains.		Decimals.		Grams.		Solotnik.	Doli.
23	=	·048	=	1·49	=	0	34½
22	=	·046	=	1·43	=	0	33
21	=	·044	=	1·36	=	0	31½
20	=	·042	=	1·30	=	0	30
19	=	·040	=	1·23	=	0	28½
18	=	·038	=	1·17	=	0	27
17	=	·035	=	1·10	=	0	25½
16	=	·033	=	1·04	=	0	24
15	=	·031	=	0·97	=	0	22½
14	=	·029	=	0·91	=	0	21
13	=	·027	=	0·84	=	0	19½
12	=	·025	=	0·78	=	0	18
11	=	·023	=	0·71	=	0	16½
10	=	·021	=	0·65	=	0	15
9	=	·019	=	0·58	=	0	13½
8	=	·017	=	0·52	=	0	12
7	=	·015	=	0·45	=	0	10½
6	=	·013	=	0·39	=	0	9
5	=	·010	=	0·32	=	0	7½
4	=	·008	=	0 26	=	0	6
3	=	·006	=	0·19	=	0	4½
2	=	·004	=	0·13	=	0	3
1	=	·002	=	0·06	=	0	1½
½	=	·001	=	0·03	=	0	0¾

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To Dye Metals.—Metals can be dyed any colour by dissolving any of the aniline dyes in methylated spirit and adding shellac. This solution must be painted on until the desired shade is obtained. If the iron has been previously painted white, so much the better.

The Worthies of Horology.

By C. Stuart Murray.

XI.

We have all heard of the famous Dr. Hooke, the accredited inventor of the balance-spring; but before saying anything further about him I may mention that his name is brought in here on account of a curious table-clock which he possessed. This clock bears the date of 1560, and was a favourite of his. The driving-train is a cylindrical brass box, richly gilt, the dimensions being six and a-half inches in diameter and two in depth, resting upon three small balls. The signs of the Zodiac are round the circular side, both astronomically and in the animal figure, Virgo having the distinction of sitting upon a unicorn. The upper surface has the Ptolemaic sphere in concentric circles, bounded by what is called the *primum mobile*—the first mover, or what we may more properly call the mainspring. In the centre of this cylinder from an upper plate rises a pillar, four inches and a-half high, on which is engraved in French a calendar of the week days. On the upper end of this pillar is supported another circular box, or rather box-circle, of four-and a-half inches in diameter, having on one side the dial face and a moveable set of astrological diagrams, and on the other side an elaborate stereographic astrolabe and perpetual calendar, the projections being adapted for about fifty-one degrees of latitude north. That would evidently be for our London, whose latitude is fifty-one degrees thirty-one minutes north of the equator. I use the term *our* London here in England, because it may not be generally known that there are no fewer than three other Londons within the regions of the English language; namely, one in Middlesex county, Canada, another also in Canada, and the third in the United States. The communication between the complex actions and the movement-train is by means of a long arm through the pillar, which arm is terminated by a strong arbour-wheel acting in contrate. On removing the lower plate of the case the balance is to be seen, but fitted with a pendulum-spring for regulating. The regulator is considered to have been made and placed there by Dr. Hooke himself. If that be so—and there seems to be very little reason to doubt it—it may be regarded as the earliest attempt of this celebrated man in the way of practical horology. Inquiry has been unable to ascertain by whom this curious piece of mechanism was constructed. I cannot learn that even Dr. Hooke knew himself, although it has been stated that he set great value upon it. The nearest that I can get to as the name of the artist is that it was Oronce Finée, who has been previously alluded to.

But, there is one character of celebrity, or rather the "better half" of two characters, who, although not a Horological "Worthy," ought to have some note of her name and history recorded here. She was very much given to the practical horology of her time, and was much addicted to expending her money in that direction. That Worthy of her kind was Queen Bona Sforza, the wife of Sigismund, the first King of Poland, known in continental State history as Sigismund the Great. Queen Bona had an astrological clock made for her that she took wonderful care of, and which clock, after passing through many phases of fortune, ultimately found a resting-place in its old age in the museum of the Society of Antiquaries, London.

Like other people, queens as well as subjects, she had her "troubles," chiefly, however, of her own contriving, but also partly from those about her wanting more than she cared to allow them, of the good things of this world. The bump of keeping her own and adding as much of other folk's belongings to it has a large and notorious development in her phrenological conformation. The public documents of her day show that she was credited with giving a high degree of elegance and propriety to the general loose and rude manners of the times. She was handsome and well-educated, but, oh, so avaricious and intriguing! She brightened up the Polish court to a brilliancy that it had never before known, and *she made it pay*. She was a truly pushing "commercial," for she sold her public offices without scruple to the highest bidder, and levying, in addition, a "black mail" that was quite equal in rapacity to that which has been previously detailed of English Elizabeth, of "blessed memory." She was the fortunate lady, and master, of a husband who was rather more than double her own age—how some wives of the high and mighty must have envied her—and he naturally glided into the quietude of second childhood. During his aged dotage, she managed to amuse herself between horological matters and governing the kingdom, with a few other trivial pleasures suitable to her age and society added. She was sufficiently astute to obtain paramount authority over the kingdom of Poland, and when her husband died she fought hard to retain it. But a Sigismund the Second came in the way, who took quite another view of the situation; and, although he was her son, he raised more obstacles and irregularities than she looked for. He finally crowned his provocation by marrying an obscure widow, who had in turn netted him, cunning and able as he thought himself. Queen Bona now plainly found that all hope of governing her son—with the power of the widow behind him—was gone. She had an Italian favourite, by name Papacauda, to whom the scandal of courtly tongues had long privately married her, and, persuaded by him, she left the land of disturbance and retired to Bari, taking her darling clock with her. When she did this, everybody outside raised their hands in thankfulness, and applauded the great act of public moral penance she was going through. But those behind the scenes were not so exuberant in their joy; they knew better. They knew that the queen had carried off immense riches in money, jewels, and costly appliances for homely luxury and comfort. Her removal was sorely against the wishes of the king and the government. They knew the treasures that she had got with her, and not without the risk of a civil war could they get them back or meddle with her.

Her career in Italy began to draw to a close much sooner than she looked for, or expected. She stayed there about thirty months, and the story goes that she was poisoned by this very favourite of hers, Papacauda; and the demoniacal ingratitude of the scoundrel may be measured by the statement that she had endeavoured to secure his fidelity by marking him down for a considerable legacy in her will, the amount of which she pleasantly but imprudently communicated to him. How full of contradiction is human nature—even the human nature that may love horology. During the residence of Queen Bona at Bari, she presented the extreme characteristics of being very pious and very amorous. Both propensities were plain and conspicuous all round. Towards the inevitable end, however, it is said that she made up for her high temperature in the last-named by her increased frigidity in her devotions. In the midst of all this contrariety she laboured under a burning desire for having a reputation for munificence, and seemed to be possessed by a kind of mania for popularity. She literally squandered her great wealth without discrimination. That she had taken care of herself when in power, may be judged of from the fact that she retained the ownership of extensive possessions, and wealthy fiscal or toll-money rights. Some idea of her large wealth may be formed from the recorded statement that she lent to King Phillip of Spain the very large sum of 430,000 ducats, or about £172,000 of our money, and although she never got a ducat back again, she was not beggared. The City of Bari still bears marks of her generous expenditure;

whilst her splendid portrait monument, in robes of cloth of gold, in the curious old Gothic Church of San Niccolo, is the attraction of every visitor; and the vaulted apartments once occupied by her are still looked upon with a kind of reverence and love.

Queen Bona, in her kindred, comes nearer to the History of England than even her horological tendencies would lead us at first sight to suppose. Her mother was known as "the beautiful Isabella of Arragon," and was the sister of that Catherine of Arragon who was one of the wives, or rather the first wife of Henry VIII., having been previously the wife of his deceased brother Arthur. Isabella, the sister of this Queen, was also unfortunate in her widowhood, had also resided at Bari, as her daughter did afterwards. Curiously enough, she, too, had a moral taint in her nature in a generally believed story, that the purity of her early character had been dimmed. The old archæologists tell us that the ancient coins of Bari, or *Barion*, as it was called, bore a winged Cupid on the reverse side. Consequently, from that they deduced a belief that the Cupid symbolised a prevalent laxity of morals among the Baresi from a very early period. That it is an ancient sea-coast city there can be no doubt, for Horace mentions it in the description of his pleasant journey from Rome to Brundusium, thus:—

> "Postera tempestas melior, via pejor ad usque,
> Bari moenia piscosi."—

"Next day the weather was better, the road worse than the day before, even to the very walls of Barium, that abounds in fish."

Barium was a town of some note, on the coast of Apulia, below the mouth of the Aufidus. It has had a history of it own. The epithet *piscosi* is given to it on account of its extensive fishery. At the present day it is called *Bari*. This river Aufidus must have been a terrible stream, for Horace says of it:—

> "Sic tauriformis volvitur Aufidus,
> Qua regna Dauni praefluit Appuli
> Quam saevit horrendamque cultis,
> Diluvium meditatur agris."—

"Thus the bull-formed [or branching as horns] Aufidus, who washes the dominions of the Apulian Daunus, rolls when he rages, and meditates a horrible deluge to the cultivated lands."

Queen Bona was much beloved by silversmiths, and goldsmiths as well, for whenever she could lay her hands—that is, "happen"—upon any of the precious metals, she immediately set her "hammermen" to work to convert what she had into something artistic. The furnace and the crucible were important factors in her idea of the refining elements of civilization—"refining" in more senses than one. When she made her moon-shooting flit from Poland to Italy, the product of her workshops in this way have been reported as something fabulous; so staggering, in fact, that the King, her son, and the states were aghast at it. But what could be done? She was the King's mother, lately the wielder of autocratic power, beloved by the common people, whose friend she always contrived to be; and as in those days of sudden resignations by potentates and powers, she might become Queen of Poland again, there was no help for it but letting her alone and trusting to that usual trust of the disappointed and despairing, the "chapter of accidents." She was a "Worthy," so far as gold, silver, horology, and jewellery were concerned, that if she took a special fancy to anything—and she was seldom without one of those "fancies"—she never permitted affairs of State to interfere for one moment in her realisation of it.

And Queen Bona had a daughter, a favourite daughter, Isabella, Queen of Hungary, who demonstrated both in letter and spirit the affirmative assertion concerning the hereditary transmission of qualities. She was quite her mother's equal in ambition, the desire to rule without being trammelled, and an ever-burning itch for the prized valuables of this life. She declared herself her own mistress at an unusually early period, and put the seal upon the declaration by being married, ere she had barely reached the age of "sweet eighteen," to a man who was fifty-two years old; and at that of nineteen she was a widow with an infant son! As was usual with such mothers in those times—fathers would never have thought of it—she surrounded her son in his green youth with every effeminancy that she knew would sap the vigour of his manhood, in order the more easily to govern him; and she succeeded. The King of France, seeing an "eligible match" for one of his daughters, proposed for the youth himself; but Isabella had, in the passing of years, arrived at ripe womanhood, and before giving an answer one way or another, took the precaution of consulting her mother. Queen Bona uttered the words of wisdom in her advice:—"Daughter, keep always the power in your own hands; you will lose it all if your son should marry the daughter of so powerful a prince as the King of France;" and there the matter came to an end.

Queen Bona was named after her grandmother, Bona, of Savoy, about whom a few words may be further added. The grandmother had a very profligate husband, even for those times, and he was assassinated in a church on St. Stephen's Day, 1476, by three young moral enthusiasts, who considered it a sacred duty to be murderers for the public good! After the victim had been "decently interred," the affair passed away, and the widow became Queen-Regent for her child, and had a new silver coin struck to indicate that event. This silver coin is extremely rare, even among Italian collectors; it was also struck in gold and copper. The murder is stated to have taken placo on the then 26th of December, 1476, the husband's name being Galeazzo Sfozza, which name the Queen Bona, the grandaughter, retained in addition to her own.

The high office of Regent did not continue. The times were turbulent, the guardianship of the child passed to one Cicco Simoneta, and both regency and guardianship were terminated on the imprisonment of Simoneta, by Bona's strong-minded brother-in-law, Ludovico il Moro, in 1479. But the coins, however, continued to bear her name until 1483, and she still exerted her influence as mother of the prince, her son. She died six years afterwards, and her son fell wholly into the hands of his unprincipled uncle, Il Moro, by whom he was ultimately poisoned. This uncle was as thorough a family scoundrel as it was possible to imagine. He not only poisoned the rightful heir, but he made continual and persistent endeavours to undermine the integrity of that young prince's wife, Isabella of Arragon. And such were the parents of the priceless astrological clock belonging now to the Society of Antiquaries! If some of those ancient timepieces—and modern ones, also,—could tell their own tale, what a history would be theirs!

I have been at some little pains in searching out what I have given here about Queen Bona; partly, because very little is known of her even as a queen, unless to the students of mediæval continental history, and partly on account of her intimate connexion with the arts belonging to this journal. Of the last-named characteristics of her life and reign there appears to be absolutely no information beyond the closets of the specially learned. Another thing, the particulars of her career as a "collector and patron of gold, silver, and precious stones," present a variety in mental catering, which must always be acceptable.

Tool for Oval-Turning.

Figures 1 to 3 show the elevation and perspective of the sections of a lathe, or throw, for oval-turning.

The mandrel *m* is mounted in bearings and headstocks, after the mode of ordinary lathes, and has a screw-nose *b*. The mandrel headstock *a* has a dovetailed slide *c*, to which is fixed a disc *d*, the mandrel nose *b* passing through the elongated opening *o*. The concentric or eccentric position of the disc in relation to the nose *b*, is adjustable by the screw nut *e*.

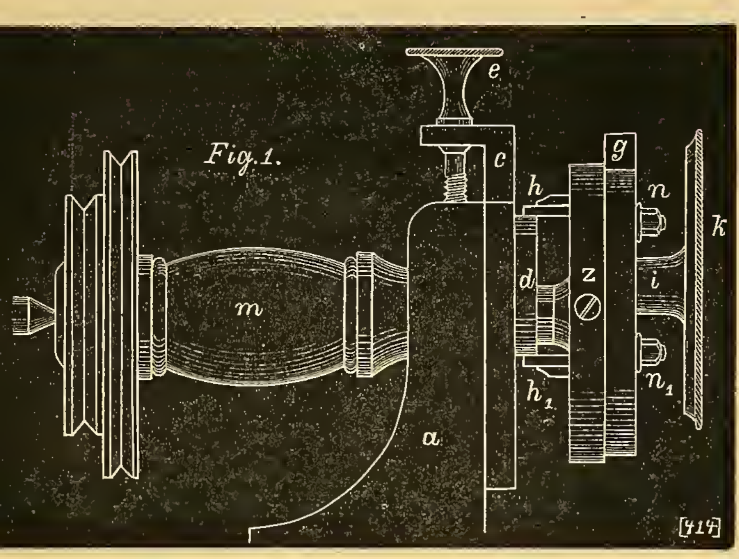
Fig. 1.

The screw-nose *b* (Fig. 2) of the mandrel *m*, carries a Chuck *z* (shown in fig 3). This chuck has a slide *g*, which carries another screw-nose *i*, and to which the thin disc *k* is screwed.

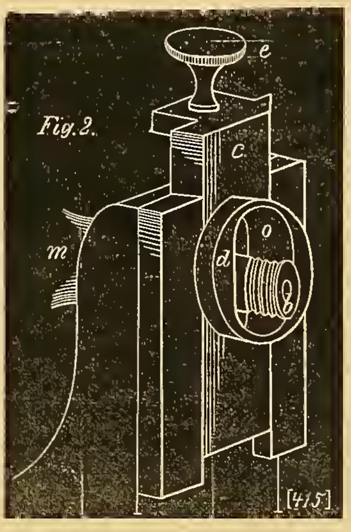
Fig. 2.

On this disc the articles to be turned are mounted either with cement, or otherwise. To the slide *g*, two guides *h h* are attached by the screw nuts *n n*, and these pass through the chuck *z*, and rest against the circumference of the disc *d*.

It will be readily seen that by rotation of the mandrel *m* (the disk *d* being eccentric with *m*), the disc *d* imparts an alternative vertical motion to the guides *h h*, hence to the slide *g* and disk *k*.

Since every point in the vertical plane of the disc *k* describes an oval, proportional to the relative positions of the centres of *m* and *d*, it follows that any article fixed to *k* must have a parallel motion, and when turned, assumes the form of the oval described by any given point in *k*.

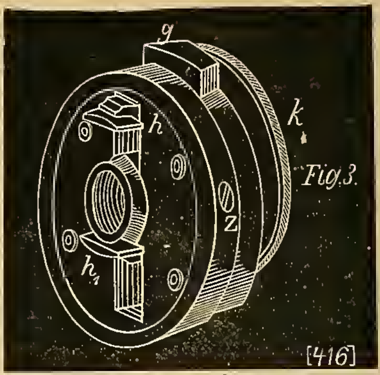
Fig. 3.

This contrivance has special advantages, some of the results of which are shown in Fig. 4.

The ovals here shown are turnings, in each of which the cutter was the same distance from the centre of the mandrel *m*, but in different angular positions.

For 1 and 5, the radius *r* of the cutter represents the major and minor radius of the respective ovals.

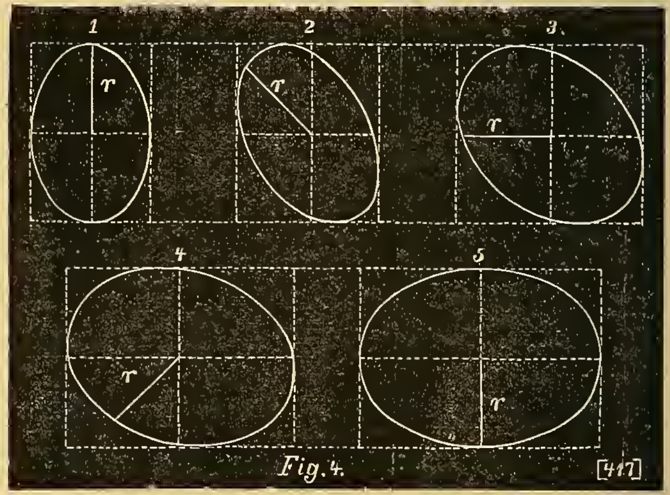
Fig. 4.

In 2, 3, and 4, it is set at angles of 45°, 90°, and 135°. From this it will be seen that ovals can be obtained with major radii of different magnitude; that the ratio of the major and minor radii is constant, and the vertical radii in the five positions is likewise a constant quantity.

The tool works smoothly, without jerking or irregularity.—*From "Journal Suisse horlogerie," "Allgemeines Journal der Uhrmacherkunst."*

Watch-Wearers' Old Grievances.

Full Plates, Gold Hands, Odd Squares.

THERE is a strong feeling among watch-wearers, that the long period of full-plate watches ought to close—except for those having keyless action. With respect to key-winders, the complaint is that the hands, having of necessity to be set on the dial, "no end" of danger is experienced. As a rule, such watches do not come under the character of "fine goods," but are mostly purchased by the work-a-day-ocracy, whose fingers, being generally stiffened by the manipulation of heavy tools and materials, the setting of the hands on the dial becomes a formidable operation of delicacy. The square, if at all shallow, is oftentimes missed, when tap goes the key upon the dial, not unfrequently cracking the enamel. Again: if the owner happens to be in a hurry, or conversing, or even "thinking" aloud, the ends of the hands are apt to be jerked upwards by something that is not supposed to be there, the edge of the coat or shirt sleeve, the result of which jerking is the outrush of a storm of very strong talk, of a nature that had better be supposed, or at the most whispered, than penned down here. I have seen it all, have gone through it myself—of course, the "strong talk" being barred—and I am quite in sympathetic accord with other sufferers, who wish that full-plate watches had never been "born;" or, for the moment, that they, themselves, had not. To go a little further: when the people who "operate" such watches are considered in their numbers, in addition to hands bending, the glass will sometimes be knocked out of the bezzle, or "atomised" within it. I have even known in extreme cases the bezzle itself part joint-company from what I call the case-ring, or the middle part. Now, it is not pleasant to see all the three hands, the little one included, taking a sight, as it were, at an angry owner who has been made so much the poorer by at least half-a-crown, and the deprivation of his timekeeper for several days.

What helps to lead up to these miseries are the different sizes of the squares. The winding-square, in my experience, has always been the largest; therefore, when you have a loose-fitting key for it, you may be sure that on the setting-square that key, in nine cases out of ten, will only just catch on the square edges. Indeed, three-quarter plates are not always free from this "stupid" imperfection of construction. I have one now, and, were it not that the key fits the winding-square rather tightly, it would not move the setting-squaro at all, and I should be obliged to use two watch keys for one watch, as many wearers have to do,—and all to keep up a vicious old custom, merely because it *is* old. Birch's keys have been recommended as an "infallible remedy" for the "disease;" but it must be remembered that it is not every one who can use a Birch key when they have got it. I obtained them for three friends of mine, but not one of the three could get along with them, and, as the saying is, "turned them up." The fault that I have to find with this otherwise useful key is, that the spiral spring is nearly double the strength that it ought to be. I use a long wood-handle bench key, which answers very well. The cause of its so answering has arisen from the fact that, upon finding the over-strength of the spring troublesome, I took it to pieces and adjusted it to my own liking. I wrote to the patentee at New York, and suggested the benefit of a weaker spring. The results, however, were not encouraging, for upon selecting another key, a couple of years afterwards, I found "the same old article," and no alteration.

It may be urged that persons who produce these winding mishaps must be very "thumb-fingered," myself included. Probably so. People who are in a hurry to get upon the van-seat, or the building-scaffold, or into the carpenter's shop, early in the morning, are not very deft in handling such fragile work as watch-keys upon dial hand-setting squares. There is an old reproof for clumsiness that's to be found in the "land o' cakes;" namely, "your fingers ar' a' thumbs." So they are when benumbed with cold, or their natural freedom of action distorted by hard work. And these are just the very fingers that should have nothing to do with full-plate watches; but, instead of that, by a curious reversal of "the order of nature," they nearly always have them!

Another time-honoured custom of the watch days that are gone, but which could be now "more honoured in the breach than in the observance," is the perpetuation of it in gold hands. Now, gold hands upon a white enamelled dial, for the purpose of seeing the time at a glance, whatever the condition of the light may be, is pretty much on a par with the wisdom of the Metropolitan Board of Works, that year after year persists, in spite of all argument and reason, in painting black letters on a white ground for the names of streets. I need not ask anyone who may go walking under the lamps, or getting up early in the winter mornings, or riding in night railway carriages, to try the effect of taking the time from a white dial with gold hands, or a similar dial with blue steel ones. I have tried both kinds under circumstances that arose; from walking along London streets after bed-time to travelling by night trains to Derby, Liverpool, Manchester, &c. What is wanted in this direction is what I will venture to name the harmony of contrast. When I have asked watchmakers the reason why the gold hands of antiquity are still kept up for optical infliction, the answer is: "You see, it is a very old fashion; besides, it gives the watch an aristocratic well-to-do-in-the-world, substantial look; and many people don't care about anything else." I asked a Board of Works member what induced them to paint the names of streets in the worst possible contrast of colours, which names were required to be more read by night than by day? "Well, black letters upon a white ground has always been the way in which street names have been painted, and we like to keep to the old style in these things. A few have been done with white letters upon a dark blue ground; but they look very glaring, and I don't think they'll be gone on with." These answers were characteristic of the men and the systems; and, commending them to the philosophical "brown study" of my readers, I will here leave them.

Returning to the main question of full-plate watches, a few more observations from the watch-wearer's point of view may be fittingly expressed.

"I cannot endure," said a watch buyer to a friend in the trade, the words being before me, "I cannot endure your thick, heavy, full-plates, opening the glass every time that I want to set the hands. My last watch was one of that kind, and as I frequently forgot to wind it, I broke no end of glasses in setting it to time. I vowed that, if I had the opportunity of getting rid of it, I would take good care never to have another; and I have so far kept my word, and mean to keep it." I have heard numbers of persons to whom I have spoken upon the subject—thorough Englishmen in everything else, but in this, say: "I would not wear one of your old full-plate turnips, unless it was a keyless watch, if you were to make me a present of it." It is the opinion of most people who have looked at this question from a watch-wearer's point of reasoning, that thick, full-plate watches should be no longer made for the British market. The continuance of their manufacture throws the balance of choice into the hands of those who, at the same price, or nearly so, give the three-quarter plate—*even* with timekeeping qualities against the latter. Nothing is more common than to hear from watch-wearers, when conversing upon this question: "I have now a three-quarter plate watch; it sets hands at the back, and, although not so good a timekeeper as my old full-plate one, it saves me a great deal of trouble in setting the hands." The thick, full-plate movements ought to be relegated to the absolute collections of the days when our ancestral sires weighed their watches in their hands as tests of horological superiority.

But all full-plate watches are not "thick-'uns," being by so much all the more sightly to look upon. Still for the reasons here given, watch-wearing opinion is decidedly against their perpetuation. A full-plate watch, it may be argued, presents that solidity of build which is so dearly loved by the English-speaking Britisher. So it does, but he would love it quite as affectionately if he had it without the drawbacks that cost him heartburning and "terrible" storming at times. I have been told that full-plate watches cost ever so much less to make than three-quarter plate. Taking that to be so, there is just the point where the manufacturing problem comes in for solution to try and make three-quarter plate *not* to cost so much more. Or, if that cannot be done, surely, it would be no difficult matter to "invent" a caliper that will place the setting-square at the back. It must be borne in mind that watches formerly had the winding-square on the dial, and that when the change was proposed it was condemned by old conservative horologists as "utterly impracticable." Yet it came, for all that, and those to whose material interests these words are addressed, in these days of high-pressure competition, will no doubt find the way out of the full-plate watch more attractive than the present to the pockets of the watch-buyers of the million.—C. S. M.

[There are several reasons why winding squares are left larger than those for setting the hands. First, they wear much sooner, and require repairing from time to time; it is equally objectionable to have the set hands square the largest. Besides, in a full-plate watch the minute hand might have to be replaced; and after all, this frequent setting of hands arises through the carelessness of wearers, who should not let their watches run down. In centre seconds watches, where the two holes come close together, it is a great safeguard to have the set square so much smaller than the other, that the winding key will not move it. A gentleman once objected to purchase one because he said that he could not wind it up "in the dark;" this is a specimen of the grievances of watch "makers." With regard to gold hands, many people "will" have them, and this often necessitates a shop keeper having a duplicate stock of watches, as buyers are most capricious, and well fitted hands are the key of the position in good watches. Some *must* have steel, because they can be worked up thinner and are less liable to injury in being put on and off. In such cases, it is good policy to keep those with gold out of sight, otherwise there is a strong probability that the last request will be to "change the hands." All Government chronometers and watches have steel hands, as also do Railway Guards' watches; these latter, although full plate, always set hands at the back; but in order to accomplish this, the balance is driven over to one side of the plate, and presents a most awkward appearance. A number of full-plates have been made to set at the back, by means of a set square passing inside the chain and carrying a nut, which acts in the minute wheel—the cannon pinion is "sprung" on, as in a full-plate keyless. In a going barrel this arrangement is less objectionable, because there is no chain to free; but for safety and soundness, the plan is not to be compared with the old-fashioned method. Three-quarter plate watches are undoubtedly preferable, but the problem at present is, how to introduce them! We recognise our correspondent's style in a letter published seven years ago in the *Horological Journal*, to which the *nom de plume* of THREE-QUARTER PLATE is attached, and yet full-plates continue to be made, notwithstanding the "suffering" that they are supposed to inflict on their unfortunate purchasers. It is only to be explained *by the fact that they are supposed to be English*, and cheap three-quarters lie under the suspicion of being foreign. This prejudice can only be removed by educating the public. At the last half-yearly meeting of the Horological Institute, the chairman, Mr. Chapman, V.P., suggested that elementary teaching on Horology should be given in our Board Schools. If this idea could be carried out, the "watch wearers" of the next generation may perhaps be more reasonable.—ED.]

The London Chamber of Commerce and the Silver Duty.

THE Gold and Silver Trades Section of the Chamber have issued a circular referring to the late action taken by it in connection with the Silver Duty, from which we extract the following:—

"The Chancellor of the Exchequer consented, at its request, to receive a representative deputation organised by it; the question was fully discussed, and, as you are aware, Mr. Childers, in his late Budget speech, gave a distinct though qualified promise—1st, to abolish the duty; 2nd, to amend the system of hall-marking; 3rd, to permit the re-exportation of manufactured articles from India, the silver composing which may be below standard, instead of destroying them, as has hitherto been the case; and 4th, with a view of facilitating the development of the silver trade, the Chancellor of the Exchequer roughly sketched a plan for creating a bonded warehouse for silver goods, in order to obviate the payment of duty on manufactured articles before they go into consumption.

"Those suggestions certainly displayed a sincere desireon the part of the Chancellor of the Exchequer to grapple with a difficult and complicated subject. Unfortunately the trade has permitted itself to be led astray by interested strictures on the bonded warehouse scheme, the plan of which was but roughly sketched in the Budget speech. This bonded warehouse idea was, after all, but a secondary portion of the Chancellor's proposals, designed to facilitate, not to hamper business; it was intended to be voluntary, not compulsory, and was really suggested by those who ultimately opposed it. In any case, this scheme could have been withdrawn without prejudice to the remainder of the Chancellor's proposals, had the trade acted less hastily. The result of this precipitous action has been that the trade, in its anxiety to get rid of the proposed bonded warehouses, has also lost the promised revision of the system of hall-marking, the permission to re-export silver articles below standard, and finally the important undertaking given by Mr. Childers to abrogate the silver duty. That section of the trade which has assumed the responsibility of this action has only succeeded in deferring, not in solving the question. The duties must come off sooner or later, and the longer the decisive day is delayed the worse must it be for all concerned. Stock holders and retailers will continue the present policy of stock-starving, the effect of which on manufacturers and workmen is now but too well known. In a word, the whole trade is condemned to suffer—retailers, producers and hands—in the sole interest of stockholders; workmen will have to turn to other trades, and capitalists will probably be coerced into transacting a direct retail trade, as is done in the United States.

"The problem admits of but one solution—the early abolition of the duty, with or without drawback to the stockholders, in order that the manufacture and sale of silver wares may develop and increase under the diminution in price which will bring the value of plate so much nearer to that of electro wares."

We may add that the Chamber advocates the retention of the system of hall-marking, subject to certain modifications.

Reminiscences of the International Exhibition of 1862.

TWENTY-ONE years ago the great display in Hyde Park was attracting the notice and securing the patronage of the civilised world, and it may be said, without fear of contradiction, that no subsequent exhibitions have exercised the same beneficial effects on British industries. A re-perusal of the valuable Illustrated Guide issued by Messrs. Cassell has induced us to reproduce certain articles which have a strong bearing on the position of the kindred industries at the present time. The first we have selected is on

WATCHMAKING.

"When it is remembered that, in addition to the whole of the watches and clocks annually produced in England, we are under the necessity of importing for home consumption watches from Switzerland, and clocks from France and America, of more than £1,000,000 worth per annum, the importance of the Horological department of the Great Exhibition will be manifest.

For this reason, and from the fact that as the foreign manufacturers increased in amount of late years, the quantity manufactured at home has fallen off more than one-third since the year 1855, this year's display of the respective rivals was regarded with much interest on all sides; it is therefore satisfactory to know that, both in quantity and quality, the English manufacturer maintained a most creditable position. A Frenchman is, however, known to excel wherever the mind and delicate touch of the artist is required to produce a thing of beauty and elegance, and there France fairly merited the place of honour.

The lesson taught by this international display proved to the English workman that his best energies must be steadily directed to external excellence, to the higher cultivation of the Fine Arts as applicable to his mechanical production, and, above all, by a better system, and, perhaps, by enlisting the valuable assistance of the female hand, to ensure a mode of manufacture which shall cheapen the cost of production. The English must produce a watch good enough and cheap enough for the million, and then it will be admitted that this great concourse of manufacturing ingenuity has not been organised in vain, and that the beneficial effect in this, as well as in many other departments, will have tended alike to the advantage of the consumer and the producer. The manufacturer will flourish, the workman will enjoy the remuneration he so richly deserves, and will find the means of attaining a higher and more honourable social position; while among the whole world of watch buyers the next generation may hope to see in days of more strict punctuality and swifter locomotion, that it will become for every man and every woman as much the custom to wear an elegant watch as to possess an enlightened head."

WORKS OF ART IN PRECIOUS METALS.

It has been too much the fashion of late years to decry the productions of the *ateliers* of British gold and silversmiths, and we think that the trade might with advantage take some decisive steps to demonstrate that the industry is still in a progressive and healthy condition. In the meantime, we have pleasure in reproducing the following extract from a pamphlet circulated by an eminent West-end firm, the tone of which cannot be too much commended. What was possible in 1862, ought surely to be equally so in 1883.

"If there is one fact or lesson which more than another the Great Exhibition of 1851 was the means of impressing upon the minds of thoughtful and educated people, it was that the English artists and manufacturers were, to a great extent, deficient in their treatment of the precious metals as a medium of art. Elegance of form and propriety of ornament were, in the majority of cases in 1851, sacrificed to a profuse display of the metal. Like some of the native princes of the East, exhibitors seem to revel in the store of gold and silver with which they could dazzle the eye and excite the cupidity and wonder of the spectator; and gold and silver seemed as though they were metals to be bought and sold by the ton rather than by the ounce. Quantity of metal, not quality of workmanship nor beauty of design, was the first consideration with too many of the manufacturers of that day, who in this respect reflected but too faithfully the general taste of the public. Our experience during the last ten years has taught us that a great and salutary change has been effected in this respect, and that the true principles of art and fitting forms of beauty are much more generally appreciated than they formerly were. It has been our object to encourage, and, as far as lay in our power, to lead this improved taste; and we may appeal to the judgment of all unbiassed minds, whether the great bulk of the works in precious metals which we exhibit do not successfully illustrate the application of some of the highest principles to their production. We have endeavoured to show rich and costly metals as the vehicle for the display of the tasteful fancies of artists of acknowledged eminence in their profession; and it is satisfactory to know that those efforts have been rewarded with a success much greater than, a few years since, we could have ventured to anticipate."

THE CAIRO JEWELLERY.

From the modern we revert to the antique. With Lord Wolseley in our minds, the subject requires no excuse for introduction.

"A collection of ancient Egyptian jewellery of extraordinary rarity, the result of researches carried on by M. Mariette, at Thebes, excited great interest. With one or two exceptions they formed part of the funeral ornaments of Queen Aah-Hoteh, the mother of Amosis, the first King of the eighteenth dynasty. Without going deeper into the mysteries of Egyptian chronology, we may say that Her Majesty lived about 1900 B.C., or 500 years before the time of Moses, which will bring her somewhere about the time of Joseph. The beautiful finish of the work was especially noticeable, and the stones with which it was ornamented retained their brilliant colour. In the front of the case was a poignard, the blade of which was elaborately chased with figures representing the fight of a lion and a bull, and close by the hilt was the cartouche, or private seal of King Amosis. Behind was a diadem of massive gold, in front of which was a box with the cartouche graven on it, supported by two exquisitely carved sphynxes. The posterior portion was set with coloured stones, lapis lazuli, cornelian, and turquoise. A massive gold chain, nearly a yard long, was suspended to a scarabæus of marvellous workmanship, and near it was a collar of equal beauty, with three large golden bees suspended from it. The most curious article was a golden boat mounted on four wheels, with twelve oarsmen in silver and a figure in gold seated in the midst, probably an effigy of the dead Queen. The most elaborate of all the ornaments was a *pectoral*, or brooch, which represented King Amosis between two divinities, who are pouring over him the water of purification. Both sides of this ornament are beautifully finished—one side in gold, the other in coloured stones. There were a profusion of other ornaments, bracelets, rings, necklaces, in gold of excellent quality, all of which were found on Her Majesty's person, and all of them, it is conjectured, made specially for her adornment in the coffin. Two great earrings of later date bear the cartouche of Rameses, of the 20th dynasty. A complete pantheon of the Egyptian deities was also exhibited, among which a beautiful figure of Isis was, perhaps, the rarest and most beautiful. A small figure of an Egyptian demon, about the size of one's little finger, in blue enamel, was unique, and a great price was offered for it by the director of the Museum of the Louvre.

Modern manufacturers have in vain attempted to reproduce the similar beautiful shade of blue—the real *bleu d'Egypte.* It was generally believed that the Egyptians had no knowledge of the art of enamelling, but this theory was destroyed by the discovery of these specimens, as well as by a votive vase found in the tomb of Amenophis (the Greek Memnon), which was ornamented with small plaques of various coloured enamels. The most curious object in the case was a sort of model mummy case; by the side of the body sits the soul, and on the side of the coffin are inscribed prayers, supposed to be addressed to the body by the soul, beseeching it to remain undisturbed until the day of resurrection, when the two will be found together again.

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The Silver Trade.

MR. CHILDERS has announced in the House of Commons that he will not touch the duty on silver plate at all, and that he withdraws his proposal to warehouse silver goods in bond, as proving no boon to the silversmiths. Two days previously he had received a large deputation, which waited on him at the Treasury to unfold the grievances of the trade of workers in silver. There was a variety of topics concerning which the representatives of this highly intelligent body of men desired to converse with the Chancellor of the Exchequer; and, although some of the wrongs for which they sought redress may be somewhat exaggerated, there can be little doubt that the English silversmiths' trade is in the reverse of a satisfactory condition, and that the manufacturers and artisans engaged in a most beautiful and useful art have really something tangible to complain of. The main contention of the deputation was that the duty on plate was detrimental to the interests of the workmen, and that the Chancellor of the Exchequer should wholly abolish the tax instead of resorting to the plan for dealing with it proposed in the Budget. In support of this appeal it was stated that during the several years which had elapsed since the feasibility of taking off the duty had first come under official consideration, the trade had suffered great depression, the manufacturers being reluctant to produce articles on speculation, fearing that, if they did so, and the tax were removed, the duty which they had paid would be so much dead loss There was a slight "spurt" of prosperity during a few months in 1881; but on the whole, work in the silver trade has been desperately slack ever since 1878; and, according to some of the deputation, many working silversmiths had been fain to abandon their craft altogether, and to turn bell-hangers, electricians, and what not. In his Budget speech Mr. Childers had proposed to hold silver goods in bond until they were sold. The deputation, however, explained to him that it was not the custom of the trade to send out travellers with samples or specimens, but with the actually manufactured articles of which they wished to dispose, and that to keep highly finished London goods in bond would be detrimental to their excellence, inasmuch as they would tarnish and would have to be cleaned by a skilled workman. One of the deputation went so far as to say that provincial workmen would not be able to clean such discoloured plate at all, and that they would get over the difficulty by re-silvering the articles "in the battery," in which case the added work would "peal off like an onion." It does not need, however, a profound knowledge of the technology of the trade to know that, although sheet silver unskilfully soldered on to copper, nickel, or other base metal might "peel off," silver deposited on the surface of a metal by the electric process does not in anywise "peel," but only imperceptibly wears off, a first-rate Birmingham article retaining its silvery sheen during many years.

The Chancellor of the Exchequer was so kind as to say that the conversation which he had had with the representatives of the London silver trade had been highly "interesting and instructive," an expression of opinion which will be shared, we should think, by all persons who are so fortunate as to own a Charles II. tankard, a pair of Queen Anne candlesticks, or a late eighteenth century tea-pot. Mr. Childers was made cognisant of several very curious details of the "faber argentarius." As to the returns for 1881 and 1882, showing an increase over each other in the amount of duty paid in London and Birmingham, the deputation explained that the augmentation was only on small articles, such as the heads of walking-sticks, lockets, and umbrella-knobs, "which the trade did not regard as anything." That for which they apparently yearn is large orders for silver services, communion plate, dinner-table sets, "testimonials," race cups, and other massive and costly ornaments; and, in commands for these, they maintain that there has been for a long period a deplorable falling-off. It is true that the middle-aged pilgrim in London has for some years missed the once-familiar sight of Hamlet's prolonged row of dusty windows in Cranbourne-alley—windows heaped high with silver salvers, goblets, dishes, plates, and candelabra—and that the name of Rundell and Bridge, whose renown as silversmiths Harriet Martineau deemed worthy of record in her supplement to a History of England, has faded out of the Directory. But Cheapside and Ludgate Hill, Bond Street, Regent Street, Oxford Street, and many other leading thoroughfares in the Metropolis abound in long-established silversmiths' warehouses. Why should their business have fallen off? Church plate must still be needed, for new churches are being continually built; and of race cups there is no end. Are there no longer any energetic chairmen of railway and dock companies, Members of Parliament with grateful constituents, successful military and naval commanders, and so forth, to whom testimonials in the shape of tea-services, epergnes, vases, or statuettes are made; or, within these latter days, have these presentations taken, preferably, the form of a portrait from the hand of Mr. Millais or Mr. Holl? Is the portrait-painter in vogue the unconscious foe of the art-workman? Still, the slackness in the demand for massive services seems a patent fact. As a rule, we are told, the trade kept three years' stock in hand. At present they do not think it worth while to keep more than a three months' supply. With respect to silver spoons and forks, the deputation informed Mr. Childers that the articles in question were not usually carried about by travellers, but were ordered direct from the manufacturers from patterns well known in the trade; and, moreover, spoons and forks were only a small part of the silver industry. The statement that nickel had not greatly affected the silver trade, inasmuch as "respectable people did not much use it," seems a startling one, when it is remembered that there are hundreds of thousands of respectable people who use nickel or at least white copper goods coated with silver, by means of electro-metallurgy; but the deputation probably meant the "German silver" and "Britannia metal," and other imitations of the precious metals which were popular in middle-class households before the wonderful development of electro-plating by the Elkingtons. The deputation, however, did admit that plated goods wrought the silversmith's trade a great deal of harm; and they added that the plated goods trade was untaxed, and that the silver used in plating the articles was also free from duty. In the end, Mr. Childers thanked the deputation for giving him so much varied and valuable information, and promised to consider well the case which had been laid before him.

The question which the Chancellor of the Exchequer had to resolve is purely a fiscal one; and, as he is certainly the best authority to decide whether the heavy duties chargeable on silver plate can be removed without detriment to the Imperial Revenue, the silversmiths must accept the answer given by Mr. Childers. This, no doubt, will be disappointing; but at the same time it is worth inquiring whether there may not be other causes of a social character, in addition to an onerous tax, which have within recent years lessened the demand for massive silver plate, both of the "services" and the "trophies" kind. While we must needs concede that the silver manufacture in England is declining, it must, on the other side, be borne in mind that the silversmith's art, in its highest sense, is all but moribund, and that our best designers are only servile copyists of old English and French patterns. We have a few splendid designers of silver ware and workers in "repoussé," but most of them are foreigners domiciled in our midst. Again, many thousands of pounds annually spent in the purchase of silver plate are diverted from the old-fashioned "services" of the Rundell and Bridge and Hamlet fashion by the fascinations of antique or ostensibly antique plate. There is very little of the genuine article to be had; but whenever an authenticated piece of Elizabethan or Caroline or Jacobean ware, or even a specimen of Queen Anne or the two first Georges occurs, it is greedily bought up at fabulous prices. An amateur who has paid ninety shillings an ounce for an old tankard thinks twice before spending three or four hundred pounds on a set of plain but solid silver dish-covers, side dishes, and plates. Venison is still served on silver in great houses; some country squires yet delight to have beefsteak pudding or yeast dumplings handed round in silver saucepans; but the silver soup tureen is disappearing, and the vast sums spent on flowers for the decoration of dinner-tables may, in many cases, seriously restrict the amount laid out on a silver "surtout." Our glass, our china, and our napery are ten times handsomer than they were a generation since; and the costliness of beautiful china may necessitate a good deal of economy in the purchase of silver for the adornment of our tables and our side-boards. Finally comes the most formidable of all the silversmith's rivals—the universal "electro." Wealthy people eat, of course, with silver forks and spoons; they have silver dessert knives and forks; letters are brought to them on silver salvers; and their candlesticks are of the same precious metal. The middle classes, however, can have, not only the articles just named, but also side dishes, dish-covers, candelabra, and epergnes, quite as graceful in fashion, quite as good in workmanship, quite as brilliant in appearance, made of "electro"—that discreet substance which may be trusted to keep its secret inviolate until it comes under the pitiless eye of the pawnbroker or the auctioneer. Thirty years ago "moderate" people, who were content to eat habitually with steel forks, usually had a little silver for high days and holidays. The working man's wife prided herself on her silver teaspoons. At present very "moderate" people indeed can obtain handsome and serviceable "electro" at a very cheap rate. The consequence may be that, as the steel fork has to an amazing extent vanished from our tables, the modicum of silver formerly laid by for grand occasions has likewise disappeared from the "moderate" household, to the commercial disadvantage of the silversmith.—*Daily Telegraph.*

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A new church clock has just been completed at Gilmorton, Leicestershire, which shows time on two 4 ft. 6in. dials, and strikes the hours upon a 14 cwt. bell, by Messrs. John Smith & Sons, Midland Clock Works, Derby.

Reviews.

A Rudimentary Treatise on Clocks and Watches, and Bells. By Sir Edmund Beckett, Bart., LL.D., Q.C., F.R.A.S., President of the British Horological Institute. Seventh Edition, revised and enlarged. London: Crosby Lockwood & Co.

This book, which has long been known to both scientific and practical horologists, formed one of the celebrated Weale series, as published in 1850. What may be termed the "germ" of it first appeared in the eighth edition of the *Encyclopædia Brittanica*, along with an article in the same work upon that useful little instrument, the Dipleidoscope, which was introduced to the public by the late Mr. Dent, of the Strand. Hundreds of them must have been made—and a demand still continues—for gentlemen who take solar noon, as they satisfy the requirements of the more costly transit-instrument. The "Rudimentary Treatise" has grown to its present size by the addition of new matter, and an enlarged chapter on Bells. Sir Edmund says:—"As this is not unlikely to be the last time that I shall revise this book, considering my age, and the number of copies printed in each edition of late (3000), and as I have had more leisure than for many years, I have endeavoured to make it as complete as possible, and have introduced more new matter and alterations than in any edition since the fourth."

It is never pleasant to hear such a horological teacher as Sir Edmund has been speak of his age as a reason why this latest edition will very likely be the last from the same pen. Still, the inevitable must be accepted and faced by all, the only hope being that in Sir Edmund's case it may be long deferred. Whatever may happen, we would strongly recommend this revised and enlarged edition to those who are in any way interested in the subjects dealt with. In these days of technical education, the scientific knowledge of the treatise will be found invaluable; stronger recommendation cannot be given.

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New American Inventions.

Mr. O. C. Retsloff, of Winnebago City, Minn., has patented an improved pendulum, the object of which is to provide for the accurate regulation of pendulum clocks by adjustment of the length of the rod. A bob is fitted to the pendulum, and rotated by an adjusting nut with a pointer attached, to indicate on a dial the extent of the movement.

Messrs. William Oldroyd, of Columbus, and George H. Smith, junr., of Lancaster, O., have patented an improvement in hair-spring studs for watches. The object of this improvement is to effect the necessary lengthening or shortening of the hair spring, and putting the watch in perfect beat without detachment of parts, or changing the collet at the centre of the balance wheel.

A delicate scale for weighing diamonds, balance screws for watches, &c., is the subject of a patent issued recently to Mr. Ferdinand F. Ide, of Springfield, Ill. The importance of a simple weighing machine for precious stones and like valuable and delicate articles, which shall be weighed accurately, is well understood. Mr. Ide, in his newly-patented scale, claims to accomplish this, and certainly his mechanism is very simple.—*Scientific American.*

Watch and Clockmakers' Pension Society.*

This Society, which is now in the third generation, as it were, of its existence, having been founded in the year 1817, appeals to the trade for an extension of support. When we consider its character and the benevolent purposes that it endeavours to fulfil with somewhat limited means, such an appeal should meet with a ready and generous response. It is not an absolute charity; perhaps it might be better for it if it were, but it struggles as far as practicable to be self-supporting; but, unfortunately, that "practicable" is not by any means as easy as it ought to be. Of course, were it not for gentlemen in the upper stratum of the watch and clock trades materially assisting to keep the Society afloat, it must ultimately run aground. If the case was viewed as it ought to be viewed, as a matter of duty, by those who might in reality consider themselves morally bound to assist—the work of the committee and treasurer would run much more smoothly than it does at present. For instance, how many scores of workmen are earning their daily bread by the mechanism of horology to whom such a small contribution as sixpence a month would be quite unfelt. We think that we are within the mark when we venture to say that there are at least three hundred watch and clockmakers not now connected with the Society, who could very readily hand over to it this proposed sixpence a month. That would be six shillings a year, and three hundred six shillings would be eighteen hundred shillings, or ninety pounds a year! That would be something towards assisting in oiling the pallets and pivots of an instrument like the Society, whose whole end and aim is the mitigation of poverty among the decayed members of the trade, and those who have died and left the partners of their lives behind them. As it is feelingly expressed in the 29th chapter of the Book of Job:—"The blessing of him that was ready to perish came upon me: and *I caused the widow's heart to sing for joy.*"

The announcement of half-yearly meeting presented six widow candidates for election on the annuity list, the claims of each having been fully set forth in the voting-papers. Although there are only vacancies for two, the following are the particulars relating to all of them.

Sarah Swainson, aged 65, widow of Edward Swainson, escapement-maker, second application. Her husband had been employed for 29 years, and had subscribed to the Society for 22 years. No income, and suffers from general debility.

Ann Stevens, aged 83, second application. Widow of D. J. Stevens, watch-jeweller; husband employed 40 years, and subscribed 30 years. Income, £6 17s. from the Society. Is bed-ridden and partially blind.

Matilda Collinson, first application, aged 69, widow of Francis Collinson, watch fusee-maker. Her husband had been employed for 55 years, and subscribed 20 years. Income 2s. per week. Suffers from rheumatism and heart disease.

Caroline Nicholson, aged 62, widow of John Nicholson, watch dial painter. Her husband had been employed 39 years, and had subscribed 25 years, and herself 10 years. Income 3s. per week. Suffers from rupture and rheumatism. First application.

Eliza Wright, aged 65, widow of Thomas Wright, spring-maker. Husband had been employed 36 years, and had subscribed 10 years. No income. Suffers from rheumatism and defective sight. First application.

Martha Waters, aged 61, widow of William Waters, watch-case maker. Her husband had been employed for 32 years, and had subscribed for 25 years. She has no income, and suffers from debility. First application.

The Society ought in good truth to be able, as far as funds could so make it, to have more frequent elections. Indeed, it is to be deeply regretted that the whole six candidates could not be placed on the Pension Fund at once; or, at the utmost, within the next three months. The shoulder is much wanting to be put to the wheel here.—C. S. M.

THE HALF YEARLY GENERAL MEETING

Was held, as announced, at the Horological Institute on Monday evening, the 30th inst., the Treasurer (J. U. Poole) occupying the chair. The poll opened at 7 and closed at 9. During its progress the usual routine business was transacted, and on the report of the scrutineers being handed to the Chairman, he declared Mrs. Waters (394 votes) and Mrs. Nicholson (317) to be elected. The other candidates received votes as follows:—Mrs. Stevens 268, Mrs. Swainson 260, Mrs. Collinson 198, Mrs. Wright 32.

A German Prize Competition.

According to a resolution of the Central Union of German watchmakers, they offer a prize of 300 marks for the best "Drawing Copies," with descriptive text for drawing classes in watch and clockmaking, subject to the condition that those selected become the property of the Association.

These drawings, together with their respective texts, are intended for the use of teachers of technical schools (Gewerbschulen) who have not any practical knowledge of horological mechanism, so that they may be enabled to make their instruction to apprentices or assistants serviceable in relation to their vocation, and also to render effective aid for the self-tuition of watch and clockmakers in horological drawing. The conditions to be observed are—

1. A short and easy introduction to drawing, and especially to mechanical drawing.

2. Twenty-five sheets of drawing copies, which shall commence with simple geometrical figures, as preparatory exercises in mechanical drawing, and advancing to more difficult problems by suitable representations, treat the technical drawing of the watch and clockmaker in an exhaustive manner. The copies shall be representations of sections of watches and clocks, tools and machines, in as far as it can be done without a knowledge of the principle of projection; likewise, representations of the various escapements, as well as complete drawings of watch and clock movements in plane and elevation.

3. The size of the copies to be 38 cm. long and 28 cm. high. They are to be progressively numbered, and the diagrams so arranged that there is a margin of 3 to 4 centimeters.

4. The text to be written on the corresponding copies, so that in drawing the student has it constantly before him.

The whole is to be enclosed in a cover, inscribed by some motto, together with an envelope having the same motto outside, and the address enclosed (which will not be opened unless approved), and addressed, not later than October 1st, to Herr R. Stäckel, Markgrafen Strasse, 48, Berlin.

Queries and Replies.

Can you, through the medium of your excellent paper, inform me of anything which will benefit me, in the matter of sweaty hands? I am very much troubled through the excessive perspiration of mine, and if you, Sir, can recommend anything to me, you would render a very lasting obligation.—F.H.

Will anyone tell me the cause of the whistling and grating sounds heard in a musical-box when out of order, and the best way to cure it? and oblige—Subscriber.

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* See Advertisement of Society, page vii.

Trade Notes.

The silver trade is again in *statu quo*, and is apparently unfortunately peculiar in having to pass through periodical terms of harassing uncertainty as to its future position. The decision of the Chancellor of the Exchequer was foreshadowed by us in our March issue, as we were well aware that the influence of those firms who took a leading part in claiming the drawback would have great weight. It is only a matter of surprise that the real workers did not assert themselves before the Budget proposals were made, as it would appear that Mr. Childers did not thoroughly understand the manner in which the trade was conducted, and it is only to be explained by the supposition that they were not at liberty to act until they had received the sanction of their employers, some of whom would probably have preferred to receive the drawback, even at the risk of the inevitable agitation which would have arisen to abolish compulsory hall-marking, in consequence of the system ceasing to be an accessory to the collection of the revenue.

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"The English Double Chronograph Company, Limited," has been formed for the purpose of acquiring and working the letters patent granted to William Henry Douglas, for improvements in chronographs. It was registered on the 5th ult., with a capital of £50,000, in £10 shares, with the following as first subscribers:—Aaron Blanckensee, Birmingham, manufacturing jeweller, 100 shares; J. Randel, Birmingham, manufacturing jeweller, 100; A. Lovekin, Birmingham, manufacturing jeweller, 50; P. M. Battin, Selby Oak, 50; W. O. Lewis, Birmingham, jeweller, 100; J. B. Cameron, Upper Tooting, 50; W. Trimmer, Alton, Hants, solicitor, 50; J. W. Lewis, Handsworth, deputy manager of an assurance society, 50. The number of directors is not to be less than 3; subscribers are to appoint the first; qualification, 20 shares; remuneration, £1 to each director for every meeting attended. Mr. W. H. Douglas, of Stourbridge, is appointed managing director, and after the shareholders have received dividends equal to £10 per cent., may receive an annual salary of £500 pounds per annum, or such larger amount as the company in general meeting may determine. For full particulars, see page 144.

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Diamonds have been rather a drug in the market lately; we have heard of their being depreciated in value some 25 or 30 per cent. This has probably been mainly caused by the uncertainty attending the result of the deliberations on the New U. S. Tariff Bill. As a matter of fact, rough stones are admitted free as before, but the proposed 10 per cent. duty *ad valorem* would have seriously affected the Amcrican diamond cutting industry, while our own might have been benefited.

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In consequence, we presume, of the publication of the article on Wages in Paris, a Dublin correspondent has sent us an advertisement cut from an Irish evening newspaper, otherwise we should regard the information as a joke; but, following the precedent set by M. Saunier, we shall not publish the advertiser's name and address. This is what he says:—"The cheapest and best house for repairing in ——. All work guaranteed. A. B., being a practical watchmaker, sees after the work personally. Repairs in many cases done at nearly one-half prices charged elsewhere. Best watch glasses fitted, ½d. Best steel-point watch key, ½d. Hands fitted, 4d. and 6d. Try once and see for yourself."

Messrs. B. H. Joseph & Co., of Birmingham, have sent us one of their "patented" bracelet-sizers, which is simple as well as ingenious. It is an article which every jeweller must require. We do not remember ever having seen a gauge before that at once measures the wrist and *records it* with perfect accuracy. It may be objected that being round in form, it cannot measure the wrist, which is oval, but the size between the wrist bones being measured, a bracelet maker having the same gauge to guide him, will be at no loss to work to it, and the little dial on the top of the gauge accurately records the measurement. It is so constructed that, being passed over the wrist, by turning the thumb-screw it is contracted or expanded to the size of the arm, and indicates on a small dial, which forms the head of the "sizer," the size of the bracelet required. Messrs. B. H. Joseph & Co. are to be congratulated on this addition to the useful articles they have already introduced to the trade.

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Sir John Bennett (! !) was robbed of his watch, chain, &c. during the progress of the ceremony of laying the foundation stone of the Birkbeck Institute, on Monday, April 21st. The *Citizen* says:—"All went well but for a misfortune that befel Sir John. Though surrounded by notabilities in Church and State, he was the victim of some strange intruder, who deprived him of a valuable clock-watch, chain, and appendages, and he had to become forthwith a customer to himself for another masterpiece of his craft." Three weeks previously (March 30th) a detailed and graphic account of his public and business career appeared in the same Journal, forming one of a series of articles under the heading of "Famous Citizens," in the course of which it is stated that he paid £750 for advertisements in the Catalogues of the "Great" Exhibition in 1851, and 1000 guineas in those of the "International" of 1862. Sir John has certainly shown the way to "make" and "keep" a name before the world.

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The marine chronometer trade is showing signs of increased vitality.

A well-known City retailer was once told by a manufacturer that he had brought him a chronometer and a *half*-chronometer. Placing his hand on the shoulder of the speaker, he said, "Come, come, don't let's talk like that to *each other;* you mean one is a *lever*." And he was quite right.

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The *Times* of April 9th states, that on the previous day Vallorbes, one of the most thriving and picturesque villages in the Swiss Jura, the seat of a considerable watch tool making industry, was almost destroyed by fire; 200 buildings, including the post-office and the railway station, were destroyed, and 1,200 persons rendered homeless. A fierce north wind was blowing at the time, and as the houses were roofed with shingles, the fire spread with extraordinary rapidity. No disaster comparable to it has happened in Switzerland since the burning of Glaris, in 1861.

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The Goldsmiths' Company have just raised their annual subscription to the watch and clockmakers' asylum, from £210 to £300.

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A Paper will be read on Wednesday evening, May 9th, at the Society of Arts, on "English and Foreign Silver Work; with some Remarks on Hall-markings," by Wilfred Cripps, F.S.A. Sir Philip Cunliffe Owen, K.C.M.G., C.B., C.I.E., will preside.

This is how an American Trade Journal writes of its contemporaries last month:—"None of the following occasions, important to associations and guild people, have been noticed by any other jewellers' paper. Wake up! you 'official,' 'recognized' 'organs!' Show a little enterprise, or take down your signs."

* * *

The Dutch International Exhibition was opened on the 1st inst., at Amsterdam, by the King of Holland, in the presence of a large and distinguished assembly. The opening address was delivered by M. Cordes, who, in alluding to the more important exhibits, particularly mentioned those sent by the Prince of Wales and the South Kensington Museum. The Netherlands capital was gaily decorated in honour of the event.

* * *

The Swiss National Exhibition at Zurich, was opened on the same day amid great festivities. The Art Exhibition is situated on the New Quay, and the Industrial Exhibition in the park near the railway station.

* * *

Some interesting information respecting the Strassburg clock is in type.

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Watch Oil.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—A very interesting discussion is now going on in a contemporary upon the manufacture of Watch Oil. Thinking some of your readers may be interested in knowing a very good oil, which I have used for the last four years with great satisfaction, I have pleasure in giving the name of it; it is Sle, London, and can be obtained through any of the London Tool Shops. Its great merit is this, it remains a *lubricator* up to the time of the watch stopping for want of cleaning, and never dries up in the fusee top, centre and fourth bottom holes; hence these pivots that are subject to so much wear are seldom worn (if they have been properly hardened and tempered) when oiled with this oil. The maker has evidently got in this oil what is most required by watchmakers, and I hope nothing will induce him to change the character of it. It has been very uniform in quality, having used several bottles, and applied it to upwards of four thousand watches.

Yours, &c.,

228, High Street, Lincoln. J. D. Fisher.

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Silver Assay by Smelting.—If no lead is present, mix 600 grs. of the pulverised ore with 300 grs. carbonate of soda, 600 grs. of litharge, and 12 grs. charcoal in a crucible; add a slight coal of borax over all, put on the furnace, melt, take off, give it a few taps to settle the metal, let it cool, and remove the button.

* * *

To Make Burnishers.—Proceed the same as in making pivot files, with the exception that you are to use fine flour of emery on a slip of oiled brass or copper, instead of the emery paper. Burnishers which have become too smooth may be improved vastly with the flour of emery as above, without drawing the temper. To prepare one for polishing, melt a little beeswax on the face of your burnisher. Its effect then on brass or other fine metals, will be equal to the best buff. A small burnisher prepared in this way is the very thing with which to polish up watch wheels. Rest them on a piece of pith, while polishing.

THE ENGLISH DOUBLE CHRONOGRAPH COMPANY (LIMITED).—Incorporated under the Companies Acts, 1862 to 1880, under which the liability of Shareholders is limited to the amount of their shares.

Capital £50,000, in 5,000 Shares of £10 each, of which 3,400 are offered to the public at par.

Directors.

Aaron Blanckensee (S. Blanckensee and Son), 15, Frederick Street, Birmingham, Manufacturing Jeweller.
John Randel, 90, Vyse Street, Birmingham, Manufacturing Jeweller.
Alfred Lovekin (Adie and Lovekin), Regent Street, Birmingham, Manufacturing Jeweller.
Philip Massu Butlin, Hill Crest, Griffin's Hill, Selly Street, near Birmingham, Gentleman.
* William Henry Douglas, High Street, Stourbridge, Watchmaker and Jeweller, Managing Director.
(With power to add to their number.)
* Will join the Board after the Allotment.

Bankers.—The Staffordshire Joint-stock Bank, Union Street, Birmingham.
Broker.—Thos. J. Moore, 95, Colmore Row, Birmingham.
Auditors.—Bunkle and Clulee, Newhall Chambers, Birmingham.
Solicitor.—G. T. Sheridan Plant, 22, Cannon Street, Birmingham.

ABRIDGED PROSPECTUS.

The Company is formed for the purpose of acquiring and working certain British and Foreign Patents granted to W. H. Douglas, of Stourbridge, for "Improvements in Chronographs," under terms which are hereinafter set out, and which are, in the opinion of the Directors, extremely favourable.

Double Chronographs have hitherto been supplied to a very limited extent only, inasmuch as, from the complicated nature of their movements, they could only be produced by specially skilled workmen in limited quantities at a very large cost.

The improvements for which patents have been granted to Mr. Douglas are of such a nature that Double Chronographs can thereby be made at a trifling increase in the cost of an ordinary watch of like quality. The basis of the instrument is the ordinary English Lever Keyless Watch, on the top plate of which a few parts are added, transforming the instrument into a perfect Double Chronograph, with double fly back; these parts are all machine made, interchangeable, and do not require to be adapted by specially skilled workmen. They can be applied to the cheapest as well as the most expensive movements, thus bringing them within the range of all classes, and affording the Company the certainty of a vast demand: there being no doubt that such articles are of great use not only to athletes, sportsmen, medical men, officers, chemists, &c., &c., but to all persons engaged in scientific and mechanical pursuits.

By pressing the winder downwards the centre finger, which registers seconds and fifths, is started; by again pressing it it is stopped, and a similar pressure returns it to zero, ready to start again. This centre finger makes a revolution in exactly one minute, and the minutes are registered as they pass on the top dial. This small minute finger is returned to zero by the same pressure which returns the centre finger. Times can thus be taken in half-hours, minutes, seconds, and fifths, at one glance, and without trouble or calculation. This does not interfere with the working of the watch, and in this it is much superior to the ordinary centre-seconds watch, which stops when the centre finger is stopped.

For the sum of £15.000, the Patentee assigns to the Company his various patents, 20,000 chronograph parts, and 300 watch movements or thereabouts. He takes £10,000 of such purchase money in fully paid-up shares, and he has engaged to act as manager of the Company, and not to receive any salary for his services until after such dividends have been paid as amount in the aggregate to 10 per cent. upon the paid-up capital.

The capital will be used in the purchase of movements, cases, &c., to which the Chronograph parts will be fitted, and Double Chronographs produced under the personal supervision of the Patentee, who is a practical man.

The Directors, who, from their connection with the trade, are specially qualified to judge, are of opinion that by adopting this means of manufacture they will secure very liberal profits, whilst they will avoid the risk and delay which always exist where large sums have to be expended in unrealisable plant, prior to the commencement of operations.

Since the invention has been brought to some extent to the notice of the trade, by means of the reports which appeared in their various journals of a meeting, held at the Midland Hotel, Birmingham, for the purpose of discussing the prospects of a Company, enquiries as to whether the Chronographs were on sale and for price lists have been forwarded from leading jewellers and watchmakers in all parts of the country, and the Patentees have supplied Chronographs to various gentlemen (amongst them the Astronomer Royal), all of whom are highly pleased with the article.

Coupling these indications with the fact that the First Prize in Horology was awarded to the Patentee, at the only competitive exhibition where the invention has been shown, and guided by their knowledge of the trade, the Directors feel justified in forming the highest opinion of the prospects of the Company, and of recommending it to the public as a sound and desirable investment.

They emphasise this confidence by resolving not to accept any remuneration for their services until the Company is in a dividend-paying condition.

The specifications were most carefully drawn by and the patents obtained through the agency of Messrs. Paine and Talhot, of 1, Bennett's Hill, Birmingham. For the convenience of transfers it is intended to apply for a Stock Exchange Quotation.

Payments: 10s. per share on application, £2 on allotment, and the remainder in calls of £2 10s. each, at intervals of not less than three months from date of last call.

The only contract entered into is dated the 19th day of October, 1882, and is made between the said William Henry Douglas of the one part, and George Thomas Plant of the other part. It may be inspected, together with a copy of the Memorandum and Articles of Association, at the Office of the Solicitor of the Company, who will furnish intending investors with prospectuses and any information they may require.

April 26th, 1883.

FORM to be sent to the Company's Banker's, the Staffordshire Joint-Stock Bank, Union Street, Birmingham, with a remittance of ten shillings per share applied for.

To the Directors of the English Double Chronograph Company (Limited).

Gentlemen,—I hereby enclose the sum of £ s. , being a deposit of Ten Shillings per share upon an application for shares, of £10 each, in the above Company. I request you to allot me that number of shares, on the terms stated in the prospectus and memorandum and articles of association of the Company; and I hereby agree to accept the same, or any less number of shares that may be allotted to me, and to pay the calls thereon from time to time as required; and I authorise you to place my name on the register of members, in respect of the shares so allotted.

Name (in full) ....
Address ....
Occupation ....

THE WATCHMAKER JEWELLER AND SILVERSMITH

EDITED BY JAMES U. POOLE.

Entered at Stationers' Hall. Registered for Transmission Abroad.

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TWO ILLUSTRATED SUPPLEMENTS:—1. Designs for Modern Jewellery. 2. Antique Rings and Ornaments.

SPECIAL NOTICE.—This Journal will be Published, in Future, on the 1st of the Month.

English and Foreign Silver Work,

With Remarks upon the Plate Duties, Compulsory Hall-Marking, and the Constitution of the Goldsmiths' Company.

By Wilfred Cripps, F.S.A.

A MOST interesting and instructive paper on the above subject, illustrated by a large collection of reproductions of historical pieces of gold and silver plate from the South Kensington Museum, lent by the Lords of the Committee of Council on Education, was read at the twenty-first ordinary meeting of the Society of Arts (May 9th), by Wilfred Cripps, F.S.A., Sir Philip Cunliffe-Owen, K.C.M.G., C.B., C.I.E., in the chair. It was at once apparent that Mr. Cripps had undertaken the arduous duties of collecting the same, *con amore*, and the detailed descriptions given by him of the various specimens which were specially brought before the notice of the audience, so far infringed upon the time at his disposal, that he resumed his seat without having read that part of the paper which related to hall-marking. The chairman called upon Mr. Watherston to commence the discussion, but that gentleman objected to do so, on account of the subject being incomplete; and the meeting concurring in his view, Mr. Cripps proceeded. As the discussion was exclusively confined to the latter part of the paper, we present it to our readers at once, and reserve the subject proper for our next issue. The report is taken from the *Society of Arts Journal*, but the actual proceedings were much more lively and desultory than are therein detailed, and finally assumed such a personal nature, that the chairman had to peremptorily interpose, and warmly expressed his regret that the consideration of a subject so fraught with historical and public interest should have been diverted by what he appeared to consider a side issue; and the non-professional portion of the audience were evidently of the same opinion. We now revert to the official report.

Mr. Cripps said, had time permitted, it would have completed the consideration of our object to have turned to a different aspect of it altogether for a few moments, and noticed the fiscal and other questions of the day that relate to the craft, viz:—The plate duties, our system of hall-marking, and the constitution of the Goldsmiths' Company.

Although I do not think that either hall-marking or the plate duties prejudicially affect the craft to any appreciable extent, questions relating to them are very persistently kept before the public.

As regards the plate duties, whilst it may be admitted that the remission of any tax upon any trade must be, of course, in itself an advantage, it is very questionable whether it is wise to keep a constant agitation on foot, in season and out of season, for such remission. No harm that the plate duties have done the plate trade can compare with the baneful result of constant agitation that has been kept on foot by a few persons for their abolition.

It is clear that the present time is not a favourable one for demanding the remission of a tax upon a luxury. The prices that are charged for articles of silver work (I mean works of art) are so high, that the duty payable upon them is but a small part of their cost; and it is worthy of note that within the last few years, the price of silver has dropped by a tangible portion of the amount of the duty so bitterly complained of, without bringing about the expansion and revival that would be the result if the duty of itself caused depression. The fact is, the intrinsic cost of the metal is so great, that no small difference in the price of silver, such as would be the result of the abolition of the duty, would bring it into competition with a rival which is of no intrinsic value at all. A man who can afford to pay £11 a dozen for spoons or forks, can equally well afford to pay £12. If he wants a salver for a present, or a testimonial, it makes no practical difference to him whether its price is £190, £195, or £200. The class of people who buy silver plate are not affected by the amount of the plate duty. If the fashion of the day dictates the purchase of antique instead of new plate, they cheerfully give its weight in gold for it, and in any quantity.

Much more strongly I would urge that the simple and consecutive system of compulsory hall-marking that has obtained for so many centuries should not be lightly abolished when it is found possible to remit the plate duties. Whatever may be said against taxation, it is really absurd to urge that hall-marking is any real or serious restriction upon trade, and it may be that those who are responsible for keeping on foot the twin agitation may have reasoned that, as the duty is collected at the same time as the hall-marking is effected, and would be very difficult to collect otherwise, an agitation that could be successfully carried on against hall-marking would very likely soon carry with it the abolition of the plate duties. Those who press for the abolition of the hall-mark, dwell upon the injury done by stamping the articles submitted to marking. They seem to forget that silversmiths themselves would have to mark their own wares with as many, probably more, detailed marks. As long as silver has to be valued for probate and legacy duties, some well-known public mark must be used, unless the appraiser is put to the necessity of causing an assay to be made in every case of disputed opinion as to quality. It will hardly be urged that the name of any individual silversmith or firm, however well-known to-day, but which will be forgotten in a few years to come, would answer the same purpose as the simple lion *passant*, and the other marks of the Goldsmiths' Company, even if such private name were to be stamped in conjunction with the words "sterling," "18-carat," "22-carat," or the like.

Lastly, those who urge the abolition of compulsory hall-marking are either ignorant of, or else carefully conceal the fact that, even free Switzerland—the freest of Continental nations, and the most intolerant of any such trade restriction—has had, after a fair trial of voluntary marking, to re-impose compulsory hall-marking throughout the Confederation within the last year or two. They also do not let us know that there is a constant agitation going on in America for the establishment of some simple and state—or, at all events, guild—system of hall-marking, such as that of which they so persistently advocate the abolition in England. I, for one, hope that we shall not be so unwise as to follow the example of France, where a system of consecutive hall-marking was abolished in 1783, only to lead to the re-establishment of hall-marking minus a year mark in 1791. From that time to this France has been restlessly changing its marks every twenty or thirty years, till she has combined as many of the disadvantages of compulsory hall-marking with as few of the advantages of our own time-honoured system, as could be desired by the most ardent Republican, loving change for its own sake.

Some people seem to forget that a trade, after all, exists for the public, and not the public for the trade; and in this case they count for nothing the value—the high value—that the public are wont to place upon the hall-mark as a guarantee and as a protection against fraud, if it gives the tradesman any trouble to obtain it. It will not be contested, even by them, that manufacturers are now obliged to get all sorts of insignificant articles stamped that are legally exempt from liability to marking, owing to their small weight; for example, the corners of pocket-books and purses, articles which, twenty years ago, nobody would have thought of hall-marking, but which now command a better price for being so guaranteed.

I noticed a letter in print not very long ago, which ended with the significant words:—"The public protects themselves as far as all other trades are concerned. Why not in the case of silver goods?" I suppose that the writer of the letter I have just quoted would say that if I want a new decanter for my sherry, and a new silver jug for my claret, I am as good a judge of the quality of the material in the one case as in the other, and as little liable to be defrauded. I do not think so, and I am the best judge of my own ability in this matter. The value of a glass decanter to a purchaser depends upon whether its shape and appearance suit him. He can judge of the transparency of the glass, and its freedom from flaws for himself. Is there really nothing beyond this that he would care about if he were buying a silver claret jug, nothing beyond what he can see for himself? I think that any one who could insist that this is so, would probably beg the question and say in reply, "Well, take the case of diamonds," or something equally beside the point.

No one who knew little or nothing about them would buy diamonds without professional advice; and partly just because they cannot be certified, by any such plan as hall-marking, to be what they are represented to be. They are only occasionally bought, and by the very rich, and they may just as well be bought on such occasions under the advice of an expert. Can this be said of articles of silver, required constantly, and though of intrinsic value enough to require some regular and simple certificate of quality, not of sufficient value to make professional advice seem indispensable? I think that if silver were not hall-marked, it is still of sufficient intrinsic value to require some other guarantee, and I think the habit that would arise of calling in some expert on the occasion of every large purchase, would soon be found a greater restraint upon the trade than the trouble of getting the goods marked in a way that the purchaser is found, in practice, to accept without hesitation as a guarantee of their quality. The public would certainly and sorely miss the lion *passant* and leopard's head crowned, from the wares of those who did not avail themselves of a system of voluntary hall-marking at Goldsmiths' Hall, or elsewhere, that would in any case have to be substituted, even if compulsory marking came to an end; and such persons would, in effect, either have to use the voluntary hall-marks as regularly as if they were compulsory, or to see their business go into other hands. This would very soon result in the old system of compulsory hall-marking being re-established by common consent, with all the disadvantage of leaving a break in the continuity of an interesting history which has lasted, at present, uninterrupted even by the events of the most troubled times, for upwards of 400 years.

I have occasionally seen the complaint carried further, and made to include not only the system, but the constitution and composition of the Goldsmiths' Company, whose duty it has been, for ages, to impose the hall-mark, and otherwise regulate the trade. It is, for example, objected that its governing body are not all silversmiths, but that certain members of its court are drawn from other classes of the community. Here, again, the public and public interest is ignored, and the matter regarded from the narrow point of view of some one personal interest. I have no doubt some people think that the governing body of the Goldsmiths' Company ought to be manufacturers or sellers of silver ware. They could certainly then manage the trade and hall-markings, and the revenues of the corporation also, their own way, and form a very comfortable and close borough. But I do not see what ground the public would have for their present confidence in it. Such corporations exist in these days for the public good, or not at all; they have ceased, and rightly ceased, to be mere trade protection societies. Considering the national importance of the Goldsmiths' Company, with its great revenues and estates, its varied duties and responsibilities as regards the coin of the realm and the protection of the public, and—I will even add--the trade, I think this Society will be of opinion that the composition of its governing body is widely enlarged, so as to include bankers, merchants, gold-refiners, lawyers, and others, as well as manufacturers or dealers in silver ware. A cry that it ought to be constituted exclusively, or even almost so, of the latter, can only be raised in the hope of destroying it altogether. It would certainly rid some people of my acquaintance of a supervision that is at present an uncomfortable check upon their business operations.

I have now noticed the questions which are kept before the public, and which are annually forced upon the attention of the Government of the day, by persons professing to represent the interests of a trade which almost entirely disowns them, and which cannot but find by sad experience that the agitation, far from doing it any good, has upset it most seriously by the uncertainties it has occasioned. It may be admitted that, theoretically, compulsory hall-marking can be made a grievance, just as compulsory vaccination can, and some other incidents of modern legislation which I need not particularise. The very objections that are raised to them, all seem of themselves to suggest the necessity of more careful, judicious, and regular application, rather than their abolition; until we can indulge in the freedom which would work well enough in Utopia, and will obtain, no doubt, under the millennium, when taxes will be unnecessary and dishonesty unknown.

DISCUSSION.

Mr. WATHERSTON thought it would have been better if Mr. Cripps had not written the last part of his paper. If he had given the smallest attention to the most elementary work on political economy, he would not have done so. Mr. Cripps said it was questionable whether it was wise to keep a constant agitation on foot, in season and out of season, for the remission of the plate duties, but he (Mr. Watherston) thought otherwise. As to the statement that the agitation had been kept on foot by a few persons, he had always found that agitations were conducted by a few persons, and when they had justice on their side, the agitations invariably were successful. Again, it was stated that the present time was not a favourable one for demanding the remission of a tax upon a luxury, but the most elementary work on political economy stated that a luxury differed in no sense from a necessity; both had an exchange value, and the one was equally, if not to a greater extent, an addition to the wealth of the world; therefore there was no sort of principle in a tax upon a luxury. As to the statement that a man who could afford to pay £11 a dozen for spoons or forks could equally well afford to pay £12, he might say that the reader of the paper evidently did not know the value of spoons or forks per dozen, or the amount of the duty upon them, because the duty upon these articles was just one-fourth of their value, so that a person, instead of having to pay £12, would have to pay £16. Further on, Mr. Cripps said, "Whatever may be said against taxation, it is really absurd to urge that hall-marking is a fatal restraint upon trade." Again, the voice of political economy was clear that all restraints upon trade were fatal to trade. John Stuart Mill said:—"It is a well known fact that the branches of production in which fewest improvements are made are those with which the revenue officer interferes, and that nothing in general gives a greater impetus to improvement in the production of a commodity than taking off a tax which narrowed the market for it." In another essay, he said:—"Any regulation whatever, enforced by law, makes it difficult for the producer to adopt new and improved processes;" and then he denounced all interference by the State in matters of harmless trade. There were other passages to the like effect which he would not detain the meeting by quoting; but he might say that he should take the opportunity of answering the statements contained in the paper at the meeting of the Social Science Congress, to be held at the end of year. As to the statement that it would hardly be urged that the name of any individual silversmith or firm, however well known in the present day, but which would be forgotten in a few years, would answer the same purpose as the simple lion *passant*, he might remind Mr. Cripps that he himself told the meeting that he had been able to fix the date of a very old piece of plate merely by the initials of the maker which he found upon it, so that the objection would not hold good. The dates of many of the most magnificent works of art in the South Kensington Museum had been fixed, notwithstanding there were no hall-marks upon them. In the case of gold, the hall-marking was entirely voluntary. No one desired to sweep away hall-marking entirely; what was wanted was a reform in the law. There was an absurd impression abroad that hall-marking was instituted to protect the public, but it was nothing of the sort. The origin of hall-marking was this. Edward I., who was always in debt and at war, objected to the export of bullion, and, on the other hand, the goldsmiths of London wanted protection from foreigners, and, in fact, from anyone outside the city walls, and they entered into a contract with the king by which he obtained money, and they got protection. Unhappily, the law then made had prevailed down to the present time. The silver trade was the only protective trade in the country, and it reminded him of the words of Schiller, "Time consecrates, and what is great in age becomes religious." He was afraid it was in that spirit Mr. Cripps had touched upon the question of hall-marking. The agitation for the repeal of duty upon silver plate would not cease until the duty had been abolished, and directly the duty was taken off, agitation would commence for the repeal of the law as to hall-marking.

Mr. MARTIN WOOD thought every one must appreciate what had been done by the authorities in the way of art-teaching, but he held that the retention of the fiscal system was checking the true growth of educational art. This fiscal system excluded the many beautiful varieties of Indian art from becoming well-known as articles of commerce, and, therefore, he could not conceive why agitation for the repeal of the duty should not be persisted in. The monetary result obtained from the duty was contemptible as compared with the result of the trade. Upon the vexed question of hall-marking, he thought it was a curious fact that hall-marking on gold was not compulsory. No doubt it was desirable that there should be some authoritative and easy method of testing articles, and an official method could be very easy instituted, such, for instance, as the option system of America. In his opinion, the operation of the enormous duties was to place an embargo upon genuine artistic articles, and to prevent freedom of trade in electro-plated goods.

Mr. Streeter said it was compulsory that certain articles made of gold, such as wedding and mourning rings, should be hall-marked. There was no doubt that the laws as to hall-marking needed reforming, in order that a stop might be put to forgery of marks on plate. The Goldsmiths' Company had a law whereby they were bound to see that no forged plate was in existence, but this duty they neglected. He should be glad to see the duty on silver repealed, but still he thought that hall-marking on gold should continue.

Mr. Liggins hoped that the paper which they had heard that evening would be published in a pamphlet form by the authorities at South Kensington, as he understood that the paper was on art plate work, and not upon ordinary articles of plate, such as spoons and forks, which were made in England for all other countries. The public had a right to have sterling silver guaranteed by a hall-mark of some high authority, so that they might not be deceived into purchasing white metal with a thin coating of silver upon it. To his mind, that was one reason why hall-marking, which had existed for 580 years, should be continued. When two eminent Chancellors of the Exchequer had proposed to deal with the question of the silver duty, the trade, and the working men in the trade, had petitioned against it, and consequently, the measure was withdrawn. He thought the late agitation had depreciated the price of silver to a most alarming extent, and only the other day he received a letter from India announcing the death of an officer, in which the following statement was made: He died from a fever, caused by the further depreciation in the value of silver, and from the fretting consequent upon the depreciation of the value of the dollar." This depreciation was a serious matter to persons in India, as they only received £80 for every £100 they earned. As an old merchant, who had paid enormous sums to the Government for duty, he might say that the agitation about the silver duty was the greatest curse to the trade.

Mr. Garrard wished to correct a statement made by the first speaker, as to the duty being one-fourth of the value; spoons of the value of £12 would weigh thirty ounces, and the duty upon this would be not more than £2 5s. He thought that nothing could be more unjust than that a person who made his living by a trade should agitate to do harm to the trade. The persons who most suffered by the agitation for the abolition of the duty on silver plate would not be the masters, but the workmen. It was not correct to say that the hall-marking of gold was entirely voluntary, for it was demanded by law just the same as it was upon silver, though the exceptions were much more extended. He could speak from experience in the matter, as he paid large sums annually for this purpose, and he was not likely to do so if he were not obliged. The time-honoured system of hall-marking had been of great advantage, and was a guarantee to the public who bought silver ornaments. As the rules under which hall-marking were carried on were made many years ago, it was no wonder if they now required some alteration. With such improvements as might be found to be necessary, he hoped the system would long continue to be compulsory.

Mr. Cripps, in reply, said that the first speaker had quoted John Stuart Mill to prove that taxation acted as a restraint to trade, but he had never said anything to the contrary, and he could not quite see what the remarks had to do with compulsory hall-marking. With regard to what had been said as to the origin of hall-marking, and that it was started for a very different purpose, that might be quite true, but things which were commenced for one purpose, very often came to answer a different purpose at another time.

The Chairman said that, for the last four or five years, the authorities at South Kensington had been endeavouring to accomplish a work not only of great importance to that museum, but with a view of furnishing articles of art to local museums, which he was happy to say were spreading all over the country. He claimed for the work done by the Lords of the Committee on Education even a wider sphere than this; what had been done for the museum at South Kensington and the local institutions, had been done for the benefit of museums throughout the world generally. It was in the pursuit of this particular work that they had had the benefit of the gratuitous services of Mr. Cripps, and without the special knowledge possessed by that gentleman on the subject of plate, it would have been impossible for the authorities to have made a selection of plate from different countries. In company with Mr. Cripps he had visited Russia, Sweden, and Denmark, and as the result of their visit, a large number of reproductions of the plate of these countries would shortly be ready for exhibition. He thought it was only right that they should pass a hearty vote of thanks to Mr. Cripps for the important services he had rendered, not only to the public, but to the trade, for his treatment of this subject in a manner which had never before been done. He had much pleasure in proposing a vote of thanks.

(To be Continued.)

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Post Office Routine.—A manufacturing jeweller in Birmingham writes to state that he recently mounted and enamelled a crown piece, inclosed it in a small box, and posted it to a customer. Not having been delivered, our correspondent made inquiries about it, and a short time ago two detectives from the General Post Office called on him and showed him the mounted coin, which he identified. He was told that it had been offered for sale by a London letter carrier. Our correspondent wrote to the postal authorities, requesting that the coin should be delivered up to him, and he received a reply stating that it should be forwarded to him on the payment of 9s. 6d., which the Post Office had paid to recover the coin. Our correspondent adds: "The authorities admit that the theft had been committed by one of their own letter carriers, and, not content that I should be robbed by their official, they add to this the insult of endeavouring to make me pay for the delinquency of their own servant. Sooner than pay one halfpenny I have informed the authorities that her Majesty's Government had better keep the crown piece, by the proceeds of the sale of which, no doubt, they will succeed in appreciably increasing the national revenue, with, it is to be hoped, a corresponding reduction in taxation."—*Daily Chronicle.*

The Worthies of Horology.

By C. Stuart Murray.

XII.

IF Horology has its Worthies, it has, also, its humourists; that is of the solid kind who make jokes pay, and pay well. It has been long known that people who have the reputation of bargain-hunting, run great risks of picking up addled eggs at times, and do, to their own discomfiture and loss.

We have among us a time-honoured serial whose appearance every month is hailed with pleasure by the reading public, and whose name is known and welcomed wherever the Englsih language is spoken. That is the *Gentleman's Magazine*, a literary treasure-house that has conjoined in immortality the names of Doctor Johnson, the great dictionary-maker, Edward Cave, the printer, and St. John's Gate, Clerkenwell, which gave "a local habitation and a name" to the other two. Cave was the friend and patron of the doctor, and at St. John's Gate the magazine first saw the light in the year 1731, and in one of the rooms upstairs, Johnson, after having come from the House of Commons, wrote the Parliamentary reports for the Gentleman's without notes—note-taking in the hall of the legislature not being then allowed. It was of these reports that he said, "I took care that the Whigs, the rascals, did not get the best of the argument." With this prefatory introduction, I may say that I have been roaming among the old volumes of the magazine to search for things bearing upon horology; and I have not been disappointed. Upon looking over this old "quaint and forgotten lore," one cannot avoid being struck by the cosmopolitan range of the subjects of a magazine of that period. Nothing seemed to be too small nor too large, too narrow nor too wide for the editor to place before his readers. Addresses to the king (George III.), our American Colonies, as the United States of a later period were called, Parliamentary proceedings, &c. &c., down to the latest curiosity—wonder, all found room in the *Gentleman's Magazine*.

Our present story from its pages goes, that more than a hundred years ago some builder's men were working about Bruce Castle, Fifeshire, when they found an earthen vessel containing a number of coins and a watch. Those they sold to a shopkeeper in the neighbouring town, making what they considered a good day's work of it. It so happened, however, that the shopkeeper had a family relative in London, to whom he sent the watch as something very ancient and very valuable. It had two cases, the outer one being of silver, having a raised pattern over a blue-enamelled ground; there was a faint outline of the letters R. B. in cypher at each corner of the chasing, thereby showing considerable artistic work. On the dial-plate was the inscription *Robertus B. Rex Scotorum.* There was no glass, a thin plate of horn doing the duty of that necessary transparency. This pointed to King Robert Bruce, without any room for doubt; and as he began his reign in 1305, and died in 1328, his watch must have been made at a very early period indeed. In was considered a small one for the period, probably what we should look upon as a fourteen or sixteen size. As the name of *Robertus B. Rex Scotorum* belongs to no other king of Scotland, the evidence upon the point would seem to be complete. It was soon spread far and wide about the discovery of Bruce's watch, after having been buried so many centuries, and a corresponding excitement was the result, accompanied by the usual "two sides to the question." In a very short time the disbelieving party appeared in print, dated from Scotland, in which the writer sought to discredit the Bruce part of the affair altogether.

He said that from his early years he had been fond of anything ancient or uncommon, and was in the habit of buying old coins from a goldsmith who worked in a private way in Glasgow, and occasionally hawking as well the articles which he had made. The writer of the letter had often asked this goldsmith if he had ever been at the Castle of Clackmannan, or had heard of any antiquities being found there? The answer was, that the goldsmith had purchased from Mrs. Bruce, who was the only survivor of the royal family in the direct line, an old watch which had been found in the Castle, which had an inscription upon it, indicating that it had belonged to King Robert Bruce. A sight of such a treasure was immediately begged as a favour, but, for some reason or another, that favour could not then be granted. What was to be done? The watch of the famous Scottish monarch within hail, but not productive to the sight! With much anxious entreaty, a time was fixed to show the relic; even when that time had arrived it was not forthcoming. This excited unpleasant surmises, as the youthful antiquary began to suspect that there was some by-play behind the scenes. He reasoned with himself that Mrs. Bruce, the last survivor, would not part with such a momento of her family, unless she was in great straits indeed, which she was not. "At long and at last" the much-looked for treasure was produced, and it corresponded in every particular with what had been so widely told about it. There was the blue enamel, the horn above the dial instead of a glass, and the inscription on the plate; but whether the words were *Robertus B.* or *Robertus Bruce*, the young antiquarian of the time, speaking from memory twelve years afterwards, said that he could not remember. As far as his recollection went, the watch was small and neat, and ran only, to the best of his knowledge, about twelve hours. The reader will please to bear in mind that the letter of which I am now speaking was published ninety-eight years ago, twelve years after the invaluable curiosity had been seen by the writer and, also, by other persons. Some daylight was soon let into the matter, in so much as that no Fife Castle was known to the writer, and that the Castle of Clackmannan had always been the ancestral home of the Bruce family. True, there is the county of Fife, an ancient district between the rivers Forth and Tay; but with the exception of the second scene in the fourth act of Macbeth, there is no castle of Fife to be found.

One disbelief begets another, and when the antiquary's suspicions had been fairly aroused, he began to examine the watch critically. He noticed that all the coins of the days of Robert Bruce had Saxon characters for the letters, and as those on the watch inscription were not so, that brought him to the conclusion that the inscription itself was not genuine. Those letters were, he said, a kind of rugged roman, or rather italic characters, like those commonly engraved, but evidently done very coarsely to favour the imposition. The price of thirty shillings was asked for it, but that, coupled with the apparent falsity of the lettering, spoiled the sale at that time. But more was still to follow. The declining purchaser made it his business to call upon Mrs. Bruce, from whom the watch was said to have come, and asked her about it, and if such a watch had ever been found. She declared most positively that she had never so much as heard of such a thing before; and there the first act of the affair ended. About seven years after that, however, the same writer received a letter from a gentleman, to the effect that a brother of his in London, who had a taste for antiquity, was very desirous of obtaining some intelligence about a watch that was said to have belonged to King Robert Bruce, which had found its way to London, and was occupying a great deal of attention among antiquarian circles. Now had come the time to inquire from the Scotch goldsmith, as to what more he had to impart upon the subject. He had risen to a full-blown shopkeeper in the meantime, and when the old story was mentioned to him, he burst out into a hearty fit of laughter. As soon as his merriment would permit him to speak, he avowed in the coolest manner imaginable, that the *Robertus Bruce* part of the affair *was his own concoction*, in order to satisfy the craving of the antiquary for marvellous information about "finds of one kind and another round that part of the country." He added that the watch was an old one that had come from America, and that to get some diversion out of the credulity of his young friend, he had engraved the inscription upon it himself, in as rude a form as he could imitate. As, however, his young friend did not bite, he afterwards sold the watch for two guineas; he had since heard that it had been again sold for five guineas, and that was the last that he had heard of it!

There was a great practical joke of horological art knocked on the head which the "Worthy" goldsmith set afloat, as he said, for his own diversion. The arguments were hot and heavy while they lasted, and had many partisans on each side, the wag of a goldsmith merrily laughing in his sleeve the while; not only at the thought of the dust that he had raised, but that he had created believers in the manufacture of watches, that such work was as old as the early part of the fourteenth century; even before Chaucer was born!

Having now related this story, it does seem strange that the exact date of the invention of watches, as watches, cannot be accurately ascertained. Peter Hele has been mentioned in these papers, and like all able pioneers in art he has been credited with work that he probably never either saw or heard of. For instance, Derham speaks of a watch which Henry the Eighth wore, which would be in the early part of the sixteenth century, and which is said to be somewhere still in existence. Again, Charles the Fifth, Emperor of Germany, who lived at the same time as Henry, was a Worthy of Horology in himself, and may be said to have kept watchmakers. So fond was he of watches, that it was his greatest pleasure to sit after his dinner with those treasures in a circle on his table, and his bottle of wine in the centre, listening to their ticking and comparing their going. Out of the last-named actions he drew a lesson of rich philosophy; namely, the folly of attempting to regulate to one standard of going the motions of the different powers of Europe. He drew that wisdom from the failure of his constant endeavours to make all his watches keep uniform time, notwithstanding that they were nearly all made alike, as they would be under the same circumstances in these days. I need only mention the extended dominions over which he held sovereign sway, to establish the fact that he was a man of a very high order of mind for any age in which he might have lived.

He was Emperor of Germany, King of Spain, of Naples, and of Sicily, and Protector of Tunis; and his son Philip was the husband of Mary, Queen of England, to whom she was married in 1554, his father then making over to him the crowns of Naples and Sicily. In the year 1555 he assembled the States-General of the Low Countries at Brussels, in order to put into effect a resolution which he had determined on some years previously. When all had been assembled, he took his seat between his son Philip and his sister, the Queen of Hungary, and in solemn form resigned the sovereignty of the Netherlands, his paternal dominions, to Philip. He then rose, and leaning on the arm of the Prince of Orange for support, as he was suffering severely from an attack of gout, he addressed the great assembly, recapitulating the leading events of his long administration, including his wars with France and other powers. He said:

"Ever since the age of seventeen he had devoted all his thoughts and exertions to public objects, seldom reserving any portion of his time for the indulgence of ease or pleasure. He had visited Germany nine times, Spain six times, France four, Italy seven, Flanders ten, Africa twice, and England, twice. He had made eleven voyages by sea; had not avoided labour, nor repined under fatigue in the arduous office of governing his extensive dominions; but now his constitution failed him, and his infirmities warned him that it was time to retire from the helm. He was not so fond of reigning as to wish to retain the sceptre with a powerless hand! If, in the course of a long administration, he had committed errors; if, under the pressure of a multiplicity of affairs, he had neglected or wronged anyone of his subjects, he now implored their forgiveness; while for his part, he felt grateful for their fidelity and attachment, and he should with his last breath pray for their welfare!"

He then turned to his son and deeply impressed upon him always to honour the laws and respect the liberties of his subjects. After going through such a trying ordeal he was exhausted with fatigue and emotion, an emotion deeply shared by all who heard him, he closed the impressive scene. Within one fortnight after this event he appeared before the nobles and grandees of Spain in solemn council, and in the presence of them and the German princes, he made over the crown of Spain and the Indies. In August, 1556, he resigned the imperial crown to his brother Ferdinand, and after visiting Ghent, his native place, he set sail for Spain. When he landed at Laredo, in the Bay of Biscay, he knelt down upon the ground and kissed it; then, raising his hands to heaven, he exclaimed—"Naked came I out of my mother's womb, and naked I return to thee, O earth; thou common mother of mankind!" He then retired to the monastery of St. Justo, in a sequestered valley in Extremadura, where he had rooms and a workshop prepared for him, and followed his favourite pursuit of horological mechanism to the end of his days in September, 1558, in his 59th year.

I can well conclude this paper here; for no Worthy of Horology, nor indeed of any other "'ology," can boast such an imperial and illustrious disciple as the emperor, Charles the Fifth of Germany.

The English Watch Company, Limited.

The above Company have recently issued their first annual report, in which the shareholders are congratulated on the fact that the anticipations of the directors, as set forth in the prospectus, have been realised. The public demand for the Company's watches continues steadily to increase, but the long depression of trade has compelled prices to rule a little lower than would otherwise have been the case. Still, notwithstanding this, a business has been done which has necessitated an enlargement of premises, and an augmentation of plant. A considerable addition of new and improved machinery—most of it designed and made on the premises—will now enable the works to meet the steady upward tendency of orders. The dead weight of formation will be greatly lightened, as many items will not appear on the expenditure side again. Although the Company has been in existence a year, the available profits commenced only a few months ago; yet, a dividend of 4 per cent. free of income-tax is available for distribution. The directors, under the feeling that the business is well established upon a sound basis, are about to issue the remainder of the 2,500 shares of £10 each, upon a call of £5 per share to meet the expanding production.

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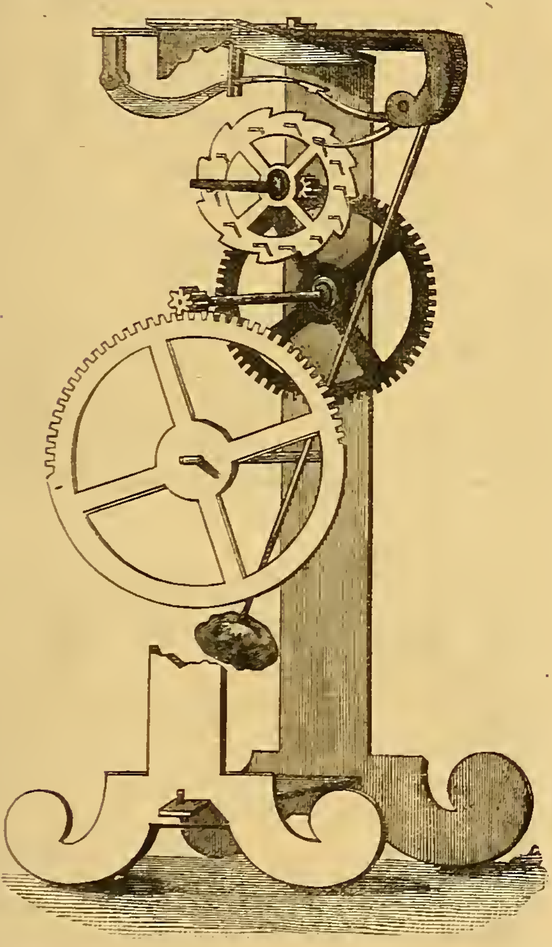
The First Pendulum Clock.

IN the Royal Institute of "Studii Superiori," Florence, is a copy of the drawing representing the first idea of the application of the Pendulum to the Clock; dictated by Galileo, then blind, to his son Vincenzo and his disciple Viviani. It is elucidated on the original of the Galilean manuscripts in the Biblioteca Palatina.

In an account which he gave Prince Leopoldo de Medici, Viviani, after having described Galileo's experiments on the pendulum, and the way in which he applied it to the measurement of time, continues thus: "but as Galileo was most liberal in communicating his inexhaustible speculations, it frequently happened that the uses and newly-discovered properties of his pendulum, spreading little by little, fell into the hands of persons who adopted them for their own ends, or inserted them in publications; and by artfully passing in silence over the name of their true author, made such use of them that it was believed—at least by those who knew nothing of the origin of the discoveries—that the writers were the real authors of them. He next speaks of the observations of the 'Stelle Mediciée,' of the tables relating to them prepared by the Padre Renieri, of the offering made by Galileo to the States General of Holland of his method for determining longitudes by means of the eclipses of Jupiter's satellites, and of Galileo's determination to send his son Vincenzo and the aforesaid Padre to Holland, since he himself, being old and blind, was unable to travel thither." He then continues: "while, therefore, Padre Renieri was employed on the composition of the tables, Galileo gave himself up to meditations on his time-measurer; and I remember, one day in the year 1641, when I lived near him in the Villa d'Arcetri, that the idea struck him that it would be possible to adapt the pendulum to clocks with weights or springs, and make use of it instead of the usual regulator, hoping that the perfectly equable and natural motion of the pendulum would correct all the defects in the mechanism of the clocks. But as his blindness deprived him of the power of making plans and models of the designs he had formed in his mind, his son Vincenzo, having arrived one day at Arcetri from Florence, Galileo confided his ideas to him, and many times afterwards did they reason over the matter, and at last settled upon the method which is shown in the accompanying drawing, and then set to work at once in order practically to overcome those difficulties which, for the most part, it is impossible to foresee. But Sig. Vincenzo intended to construct the instrument with his own hand, in order that by this means the secret of the invention should not be reported by the artificers before it had been presented to His Serene Highness the Grand Duke, his master, and to the States General (to be used for observing the longitude); but he put off the execution of his work so frequently that a few months later Galileo, the author of all these admirable inventions, fell sick, and on the 8th of January, 1641, 'ab Incarnazione,' according to the Roman style, he died; and, consequently, Sig. Vincenzo's energies so cooled down that it was not until the month of April, 1649, that he actually began to make the present clock upon the idea explained to him by his father Galileo. He then managed to obtain the services of a young man—who is yet living—named Domenico Balestri, a locksmith, who had had some experience in making large wall clocks, and he made him construct the iron frame, the wheels and arbors; but the tooth-cutting and the remainder of the work he executed with his own hands, constructing on the highest wheel, called the scape wheel (*tacche*), twelve teeth with as many pins (*pironi*) spaced between the teeth, and with a pinion of six leaves on the same arbor, and another wheel of ninety teeth, which moves the above-mentioned. He then fixed on one side of the support which is at right-angles to the frame the detent (*scatto*) which rests on the scape wheel, and on the other side he fixed the pendulum, which was made of an iron wire screwed at the lower extremity for the attachment of a ball of lead, so that it could be lengthened or shortened for regulating. When this much had been done, Sig. Vincenzo wished me (as one who was in the secret of this invention, and who, indeed, had urged him on to complete it) to see, by way of trial, the combined working of the weight and the pendulum. I observed the mechanism in operation more than once, and his workman was likewise present. When the pendulum was at rest, it prevented the descent of the weight; but when it was raised and then let go, in passing beyond the perpendicular, with the longer of the two arms attached to the pivot of the pendulum, it raised the detent which fits into the scape wheel, which wheel, drawn by the weight in rotating with its higher part moving towards the pendulum, pressed with one of its pallets on the other shorter arm, and gave it, at the beginning of its return, an impulse sufficient to cause it to swing to the height from which it had started, so that when it fell back naturally, and had passed the perpendicular, it returned once more to lift the detent, and immediately the scape wheel was set in motion and gave a fresh impulse to the pendulum; thus, the swinging of the pendulum was rendered continuous until the weight had reached the ground. We examined the operation together, connected with which, however, many difficulties arose, but Sig. Vincenzo did not doubt but that he would be able to overcome them all; indeed, he fancied that he would be able to apply the pendulum to clocks in a different manner, and



by means of other inventions; but since he had got so far, he wished to finish it on this plan, as the drawing shows it, with the addition of hands to show the hours and even the minutes. For this purpose he set to work to cut another cog-wheel. But whilst engaged in this work, to which he was unaccustomed, he was overtaken by a very acute attack of fever, and was obliged to leave it unfinished at this point, and on the 22nd day of his illness, on the 16th May, 1649, all his thoughts and aspirations, together with this most exact measurer of time, were for ever lost to him. He, their author, passed away to measure (let us hope) in the enjoyment of the Divine Essence, the incomprehensible moments of Eternity.

◆

New Hour and Quarter Repeating Motion for Clocks, with a Single Striking Train.

Patented by Klumak Bros., Vienna.

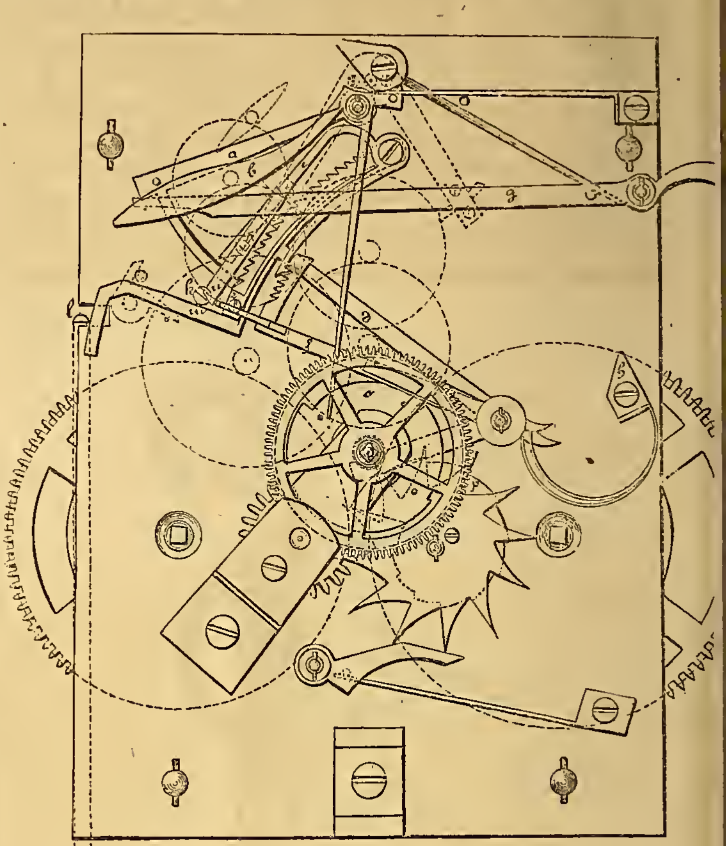
Clocks which strike the quarters, and repeat the last hour at every quarter, are plentiful on the Continent, and are generally known by the term "Vienna Clocks." It is singular that this kind of clock has never established itself in England; for certainly it appears more practical than the ordinary quarter or chime clock. With the latter we are quite uncertain as to what hour it may be when it strikes the three first quarters, and at night time, leaves us quite in the dark as to knowing what time it is, unless we happen to wake up just at the hour, or have the misfortune or patience to lay in suspense for, perhaps, nearly an hour, until it pleases the clock to define the interval that separates us from the next meridian.

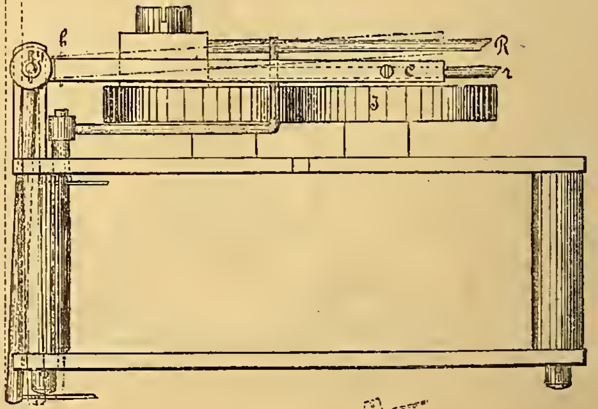
A "Vienna Clock," which strikes the past hour every fifteen minutes with the quarters, indicates our "whereabouts" often enough, and is certainly a convenience; hence their popularity elsewhere is less a matter of surprise, than their unpopularity in this country.

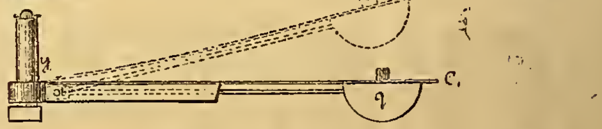
Like the English chime clocks, these clocks have three trains, viz., going quarter, and hour train. The Klumak clock, while it retains the characteristic as to the mode of striking, dispenses with one train, and thus makes one do the work of two. Its construction is shown by the accompanying sketch.

The wheels and pinions of the going and striking trains, which are indicated by dotted lines, have the following numbers. Going train: great wheel, 96; centre wheel, 72; third wheel, 64; escape wheel, 30 teeth. Striking train: great wheel, 104; lifting wheel, 96, and 24 lifting pins; gathering wheel, 72; warning wheel, 72—all have pinions of 8, *f* is the quarter rake, and *d* the hour rake. Both are movable about a common axle. They make a small angle with a horizontal line, and therefore fall back by their own weight, and by the action of the double spring *h*. The gathering pallet *n* is of ordinary form and acts into the hour rake; *a* and *b* are the retainer and reliever of the hour rake, and are moving concentric. *g* shows the repeating action. The quarter cam is fixed to the canon, and is shown through the hour wheel, and marked with *o*. Below these is the hour cam and star *p*, the cam being below and the star uppermost. The pin which locks the gathering pallet is attached to the quarter rake.

The retainer *c* of the quarter rake is moveable about a screw in the end of the hour rake, and has a curved wing *i*, which starts from the centre of motion, and is brought round over the gathering pallet. The quarter retainer is kept in position by a spring *e*, which is screwed to the hour rake. The second and third figures show the hammer action. *y* is the hammer axle, one end of which carries the hammer, and the other end projects above the plane of the front plate, so that the wing *m* of the hour rake can make contact, and moves the hammer from the quarter on to the hour bell or gong, in the transit from the quarters to the hour. The massive wing which carries the hammer is filed out in the form of a fork, and between the two prongs has a pin *C*, which is the centre of the hammer lift, and in a line with the axle of the lifting arbor.







The spring for supplementing the energy of the hammer shown by *c* is fixed to the hammer and acts against the section *y*. The lifting arbor has an arm which is bent at right angles, and thus affects the raising of the hammer. *R* and *r* represent the quarter and hour gongs, and *I* their base.

The action is as follows:—When the motion is unlocked, both rakes fall back on to their respective cams. By

CHATWOOD'S "INVINCIBLE" SAFES

HIGHEST AWARDS ALL EXHIBITIONS

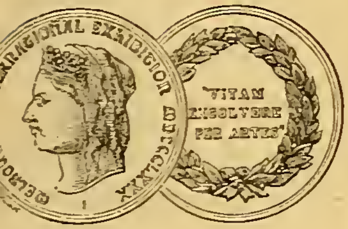
GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST. E.C.

MELBOURNE
International
Exhibition.
1880-1.

SPECIAL

GOLD MEDAL


INTERNATIONAL EXHIBITION MELBOURNE MDCCCLXXX
VITAM EXCOLUERE PER ARTES

AND

THREE FIRST
ORDERS OF MERIT.

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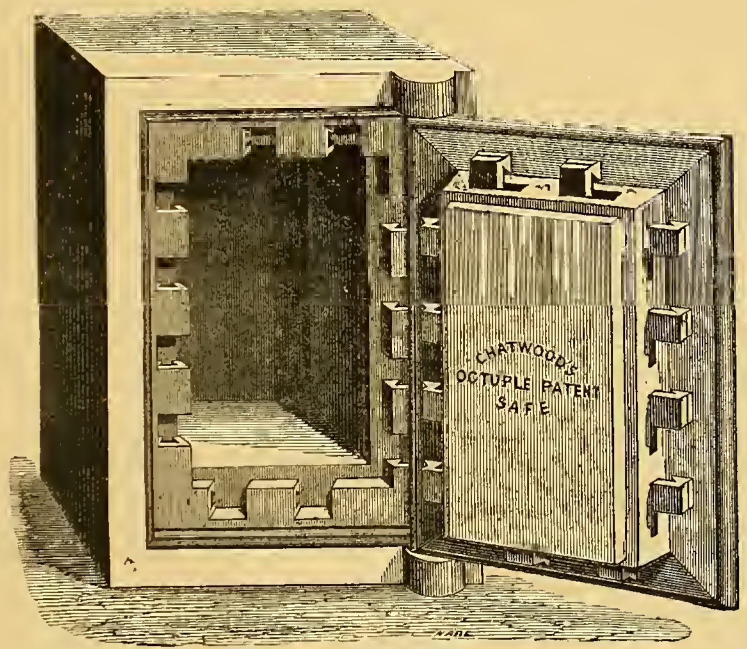
LONDON.

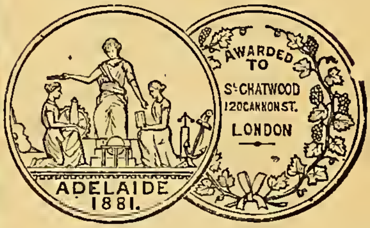
22, BOND STREET,
LEEDS.


CHATWOOD'S OCTUPLE PATENT SAFE

ADELAIDE
International
Exhibition.
1881.

SPECIAL

GOLD MEDAL


ADELAIDE 1881.
AWARDED TO
St CHATWOOD
120 CANNON ST.
LONDON

AND

THREE FIRST
DEGREES OF MERIT.

11,
CROSS STREET
MANCHESTER.

WORKS: BOLTON.

CHATWOOD'S "INVINCIBLE" SAFES

HIGHEST AWARDS ALL EXHIBITIONS

GOLD MEDALS, PARIS 1878, SPECIAL FIRST SIDNEY 1880, FIRST MELBOURNE 1881.

LANCASHIRE SAFE & LOCK WORKS, BOLTON ENGLAND. LONDON ADDRESS 120 CANNON ST. E.C.

ENGLISH *v.* FOREIGN MANUFACTURE.

So much has been heard lately about the improvement in workmanship abroad and of its deterioration here, that it is gratifying to find an instance where England has fully maintained her old pre-eminence. The Dutch papers just to hand contain reports of the trial of an English safe, which was brought about somewhat strangely. It appears that some time since there was at Arnhem an international exhibition under the authority of the Government of the Netherlands. Among the objects intended to be tested, and for which medals and rewards were offered, were safes. The conditions of competition were prepared by authority, and they stated that a safe was wanted that should be at once fire-proof, fall-proof, and burglar-proof. A gold medal and a money prize was offered to the most successful maker, and a silver medal and a smaller money prize to the second. Mr. Samuel Chatwood, the well-known English safe manufacturer, determined to compete for the prize, and made a safe to answer the conditions imposed. It happened, however, that the Netherlands Minister of Commerce asked him to assist on the jury; he was elected president, and that made competition on his part impossible. There were twelve competitors; nine of them were Dutch and three German. The first hour's fire over, the fall test followed, and two of the safes were utterly broken, and so placed *hors de combat*. The remaining ten went through the second fire test, and it was afterwards found that in each the papers inside were charred. Two workmen, with a set of ordinary burglar forcing tools, undertook the burglar's task, and opened all the ten safes in twelve hours. No safe withstood their attack for four hours, while one was opened in less than five minutes. There were complaints, and several of the safe-makers and others interested said openly that the conditions of trial were such that no safe could stand. On this Dr. Bosscha, the president of the international grand jury, asked Mr. Chatwood if he would consent to his safe being submitted to the same tests. He consented, and the trials took place on the 20th of December at Amsterdam.

The announcement caused considerable excitement among the safe-makers on the Continent. M. Van der Maden, the Director of the royal factory for the making of steam and other engines, found the space on which the trials were to take place. On Saturday morning, the 20th December, a goodly number of people assembled, and before the firing test began there were present many of the principal inhabitants of Amsterdam, including members of the Government, of the Town Council, of the Army and Navy, as well as of merchants and manufacturers. Almost all the safe-makers who competed at Arnhem were there to see how this English safe would bear itself under the conditions which led to their easy defeat. Four brick pillars were built on a circular brick base, and on these the safe was placed, the hauling being done by a powerful crane resting on huge shears. The safe was 5ft. high, 2ft. 7½in. wide, and 2ft. 2½in. deep; it weighed 2 tons. As soon as it stood in its place, several men heaped about it plenty of wood in large and small pieces, and then started the fire. Before it had burned ten minutes, the fuel reached to and lay on the top of the safe, and so intense was the heat that the hundreds of people about were forced to keep their distance, and a small fire engine was called into requisition to play on the shears and save them from combustion. After burning an hour the safe was lifted to the height of twenty feet and pulled over a stone-laid floor for the second or fall trial. This trial was more severe than was intended, for before the men were ready the slip-hook was accidentally released, and the safe came down with a tremendous thud on the stones, breaking and sinking them into the hard frozen ground. No effect of any kind was produced on the safe, and it was again subjected to fire for three hours longer. Here again the test was more severe than at Arnhem, for while there only eight cubic yards of wood were used as fuel, at Amsterdam twelve cubic yards were burned. There was much speculation as to the condition of the safe, most of the safe-makers present being convinced that the fire test had been too much for it.

On the Monday morning the interest seemed to have increased, as there was again a large assembly of people to see the lifting of the safe and the placing of it in a shed to be submitted to the burglar-proof test. The jury had invited the competitors of Arnhem to select two of the most skilled workmen they knew to undertake this, but they all declined, notwithstanding the fact that Mr. Chatwood offered a reward of 100 gulden to the workmen who succeeded in opening the safe. Under these circumstances M. Van der Maden found two, one of them having been a safe-maker for twelve years. They were complimented all round on the skill they displayed in finding points of attack. They had brought their own tools with them, and were permitted to use them or those which were used at Arnhem. They elected to use the latter set, weighing 56 lb. They set to work, but after two hours' hard labour gave up, saying they had broken all their chisels and bars. Mr. Chatwood then consented that they should use also the tools they themselves had brought, another weight of 56 lb. They set to again, but were just as much foiled. All the time they were at work some of the safe-makers stood close by, and were continually making suggestions.

This failure being complete, Mr. Chatwood resolved to try to open the safe, so as to get at the contents, by machinery next day. At five minutes to ten the next morning, after drawing the safe to its place under a powerful radial steam drilling machine, the men commenced to drill out the stud bolts of the door, under Mr. Chatwood's superintendence. The working drawings not being at hand, the exact position of these studs could not be told, which necessitated the drilling of three holes for one stud and two holes for another in the bottom of the door. During the time this drilling was going on the machine was running at its highest power. After this, at Mr. Chatwood's request, an attempt was made to drill out the lock. The attempt proved futile on account of the point of the drill coming into contact with the hard metal intersection between the lock and the outer door. After placing considerable power on the drill it was withdrawn. The point of the drill was found completely rounded off in the attempt to get through the hard metal. After all the studs were drilled out, and therefore the actual holding power of the door was gone, an attempt was made to prise open the outer door by means of sets and heavy sledges. This, however, proved completely unsuccessful. The safe was then turned on the side on which the hinges were, and two large holes drilled on this side by the radial drill. After this, by means of large steel drifts and a further application of the crowbars, the door was at length opened. This was not until about four o'clock, and many men had been employed. A change of hands for the hammers was employed throughout, about ten of the best men in the works being told off for the duty. The interior door was opened by its own keys after a delay of about twenty minutes, the delay being occasioned by the bolts having become rusted into their holes by the condensation of steam during the fire proof. On the door being opened the papers were found in every respect in as good condition as when put in the safe before the fire test.

The trials were under the special direction of Dr. J. Bosscha, Director of the Polytechnic School of Delft; Ph. Lindo, Director of the Cement Factory, Delft; H. A. Raveneck and J. G. Snijders, Professors of the Polytechnic School, Delft; H. L. Woltersom, Civil Engineer, Arnhem—these being the president, secretary, and members of the jury for the international concours held at Arnhem. These gentlemen have signed and issued an official report, in which they state that the safe stood each test perfectly; that all the documents in the safe were uninjured, writing and printing being exactly as when placed inside; and they further say—"On the strength of these trials, the undersigned judge that the requisites demanded in the Arnhem programme and tests for a safe constructed on proper principles have proved by no means too severe for the safe of Mr. Chatwood; nay, that in all probability Mr. Chatwood's safe would have stood a severer test for fire, falling, and burglary."—From the *Morning Post*, January 10, 1880.

this movement the projecting piece m is relieved, and the hammer transferred from the hour to the quarter gong.

The wing i of the quarter retainer, at the moment of drop of the rake, slides over the pin R, by which its contact with the quarter rake is adjusted.

The hour is struck first, and when completed, the end of the wing i becomes disengaged from the pin R, and the quarter retainer drops into the rake, and is then propelled until the train is locked by the contact of the gathering pallet with the locking pin. At the instant when the quarter rake comes into action, the hammer is brought over on to the quarter gong, by the action of the wing m.

The pin K is inserted in the plate of the clock, and therefore is a fixture; hence, the wing i is always relieved, and therefore the further the quarter cam allows the quarter rake to drop, the further will the action commence from the locking pin, whereby the right number of quarter strokes are determined.

To be Continued.

A Disclaimer.

TO THE EDITOR OF THE "WATCHMAKER, JEWELLER, AND SILVERSMITH."

Sir,—The remarkable parallelism between the section of Mr. Wright's lecture relating to "Barrel Area," as published in the *British Horological Journal* for April, and a series of articles on this subject in the *Watchmaker, Jeweller, and Silversmith* for January, February, and March, 1882, suggests the existence of an older copy from whence these are obtained, and thus lays me open to the charge of plagiarism.

Though I am not in a position positively to deny such an existence, I can certainly disclaim any knowledge of it, and avow originality in the matter in question as to the elimination and technical application of the old climatary formula, an "annular space."

This can certainly not be said by Mr. Wright, for he was well aware of priority in one case at least; and as he was careful to give a reference for his other quotations, justice, if not courtesy, ought to have led him to give the same measure in this case, whether it is due to me or some one else.

I am, Sir, yours obediently,

I. HERRMANN.

Origin of the Decimal System.—To India belongs the honour, and are due the thanks of the world, for having first discovered the local value of figures, and enriched it with one of the most valuable inventions, viz., the decimal system. This method of manipulating figures was first worked out at the Academy of Madura, in India, in the eighth century of the Christian Era, but was practised for a long time exclusively by the "Scientists" of that day, and wholly unknown to the million. Europe learnt the use of these figures from Arabian writers, who had obtained their knowledge from the Indians. For a long time they were known by the term "Arabian Figures," in contradistinction from "Roman Figures," which up to that period had been in general use, and are not wholly displaced by the former at the present day. In the fifteenth century they were first introduced into the higher arithmetic by Purbach and Regiomontanus, from which date they became more generally in use in Europe.—*Allgemeines Journal der Uhrmacher Kunst.*

Philosophy of Precious Stones.

(From History and Mystery of Precious Stones, by William Jones, F.S.A.)

WHAT, may we ask, observes a writer in the *Edinburgh Review*, "have been the sources of that fascination which precious stones have, from time immemorial, exercised over the minds of men? How comes it that, in this nineteenth century, a little diamond not half the weight of a sixpence will sell for four hundred pounds, and as small a ruby for six hundred or seven hundred? Just as in the days of the Triumvirate, the opal of Nonias, a stone no bigger than a hazel-nut, was valued at twenty thousand pounds of our money, yet its owner went penniless into exile rather than surrender it to the greed of Marc Antony. What can thus gift these little bits of stones with such extraordinary value? What sort of passion is it that would seem so little restrained by conscience or by reason? To say that it is mere cupidity, is not to explain it. The imagination certainly enhances the pleasure derived from the beauty of a diamond, a ruby, a sapphire, or an emerald, for only an eye trained by custom, or instructed by science, can distinguish these stones from their glass counterfeits. It is not, therefore, this beauty alone that gives them their value. Nor is it their adaption for practical uses that confers on them this quality; for, except in the limited application of diamond-dust, to what useful purposes are these stones applied? Nor is it their mere rarity, else would an ounce of platinum be worth a thousand times more, instead of four times less, than an ounce of gold, and many a substance in nature would be precious far beyond the diamond. It is not, then, the desire merely to possess what others have not. It is rather the passion of doing what others do, and possessing what it is the fashion to possess, that gives these tiny stones their price. They are pretty objects, and comparatively rare, and they have the advantage of being almost indestructible, in consequence of their hardness. But what makes them worth many pounds a grain is, that they have acquired by tradition a prestige which fashion perpetuates—a prestige rooted in strange attributes and mystic powers, wherewith the fancies of five thousand years have endowed such stones—a passion that has been ever pandered to by a harpy host of money-making parasites, and has been fostered by that human weakness, which, while endeavouring to associate what is pretty with what is costly in the material chosen for personal ornament, is apt to attach more importance to their price than to their real beauty, in proportion as cupidity is a passion more common than refinement or taste."

Renodeus, quoted by Burton in his "Anatomy of Melancholy," admires precious stones because they adorn kings' crowns, grace the fingers, enrich our household stuff, defend us from enchantment, preserve health, cure diseases; they drive away grief, cares, and exhilarate the mind.

"There are," says Bacon, in his "Sylva Sylvarum," "many things that operate upon the spirits of man by secret sympathy and antipathy. That precious stones have virtue in the wearing, has been anciently and generally received, and they are said to produce several effects. So much is true, that gems have fine spirits, as appears by their splendour, and there may operate, by consent, on the spirits of men, to strengthen and exhilarate them. The best stones for this purpose are the diamond, the emerald, the hyacinth, and the yellow topaz. As for their particular properties, no credit can be given to them. But it is manifest that light, above all things, rejoices the spirit of men; and, probably, varied light has the same effect, with greater novelty; which may be one cause why precious stones exhilarate."

Plato, whose vast intelligence has made him so illustrious, gives a romantic idea of the origin of precious stones. He admits that, real animated substances, they were produced by a species of fermentation determined by the action of a vivifying intelligence descending from the stars. He describes the diamond as being a kernel formed in the gold and supposed it was the part the most noble and the purest that was condensed in a transparent mass.

Theophrastus, a disciple of Aristotle, divides stones into two sexes, male and female.

It is to Dioscorides that the mystic virtues of precious stones had their full development.

"In good sooth," says De Boot, "I am fain to confess that supernatural effects are after this fashion produced, God having permitted that it should be. But, as I have already said, this is done by evil spirits, who take up their abode in the substance of the precious stones, constrained thereunto by the vain credulousness of man, and by a Pagan impiousness; taking undue advantage of the stone, to the end that they may conceal or annihilate the natural faculties, rendering them unrecognisable, and substituting in their place false ones, and by these means leading man to vanities and superstitions, making him forsake the true worship of God, subjecting him to their will, and losing his soul to all eternity. Those, therefore, who would attract good spirits to inhabit their gems, and benefit by their presence in them, let them have the martyrdom of Our Saviour, the actions of His life, which teach virtue by example, graven upon their jewels; and let them often contemplate them piously; without doubt, with the grace of God and the assistance of good spirits, they will find, that not in the stone only, or the graven image, but from God, are its admirable qualities."

In Gargantua's noble letter to his son, Pantagruel, on the thirst for knowledge, he is recommended to give himself "curiously," amongst other matters, "to all the metals that are hid in the bowels of the earth, together with the *precious stones* that are to be seen in the east and south of the world."

Sir Thomas More, in "Utopia," ridicules the ornaments then worn on hats: "When the Anatolian ambassadors arrived, the children, seeing them with pearls in their hats, said to their mothers, 'See, mother, how they wear pearls and precious stones as if they were children again.' 'Hush,' returned the mothers, 'those are not the ambassadors, but ye ambassadors' fools.'"

He tells us, also, that his Utopians "find pearls on their coasts, and diamonds and carbuncles on their rocks; they do not look after them, but, if they find any by chance, they polish them, and therewith adorn their children, who are delighted with and glory in them in their childhood, but when they grow to years, and see that none but children use such baubles, they, of their own accord, without being bid by their parents, lay them aside, and would be as much ashamed to use them afterwards, as children amongst us, when they come to years, are of nuts, puppets, and other toys. These Utopians wonder how any man should be so much taken with the glaring doubtful lustre of a jewel or a stone that can look up to a star, or the sun itself."

"The Utopians have no better opinion of those who are much taken with gems and precious stones, and who account it a degree of happiness next to a divine one, if they can purchase one that is very extraordinary, especially if it be of that sort of stones that is then in greatest request; for the same sort is not at all times of the same value with all sorts of people; nor will men buy it unless it be dismounted and taken out of the gold. And then the jeweller is made to give good security, and required solemnly to swear that the stone is true, and that by such an exact caution, a false one may not be bought instead of a true; whereas if you were to examine it, your eye could find no difference between that which is counterfeit and that which is true; so that they are all one to you, as much as if you were blind."

There is the usual quiet satire in this, as in More's other studies of mankind, and levelled more against the extravagant display of jewels which particularly distinguished the period in which the learned chancellor of Henry VIII. flourished. No doubt the excessive luxury of dress, the absorbing passion to excel others in rare and costly decorations, lead to habits of dissipation and folly; still precious stones, those wonderful productions of nature, have been of invaluable advantage to mankind in assisting the development of art, and exercising in countless ways the skill and ingenuity of man. The antique gems that enrich the cabinets of collectors are models of beauty and perfection to the artist and the man of taste, and have been the means of adding greatly to our historical and antiquarian knowledge.

Sir Thomas More, however, was one of those men who practised what he preached. "His sonne John's wife often had requested her father-in-law, Sir Thomas, to buy her a billiment sett with pearls. He had often put her off with many pretty slights; but, at last, for her importunity, he provided her one. Instead of pearles, he caused white peaze to be sett, so that at his next coming home, his daughter-in-law demanded her jewel. 'Ay, marry, daughter, I have not forgotten thee!' So out of his studie he sent for a box, and solemnlie delivered it to her. When she, with great joy, lookt for her billiment, she found, far from her expectation, a billiment of peaze; and so she almost wept for verie griefe. But her father gave her so good a lesson, that never after she had any great desire to weare anie new toye."

Painted Diamonds.

BY H. C. HOVEY.

THE latest fraud in precious stones furnishes a curious confirmation of the law of chromatic contrasts, and an unexpected illustration of Shakespeare's saying:

"TO GILD REFINED GOLD, TO PAINT THE LILY."

About six months ago the owner of a magnificent gem, which he had supposed to be a Brazilian diamond of the first water, suddenly found it reduced to about one-fifth its value by being accidentally washed with soap-suds. This simple process revealed its true character as a yellow African diamond of inferior grade. This trick, which was originally played in Paris, has since been reproduced in America, and it is rumoured that a single firm in Chatham Street was thus swindled out of many thousands of dollars, without being able to detect the perpetrator of the fraud. A case of the sort is now in the New Haven courts, being tried by Judge Deming, some of the particulars of which may be of interest, and serve to put persons on their guard against what is really an ingenious deception.

Jacob Nepel, a manufacturing jeweller in that city, had several diamonds, apparently of great value, which he disposed of by an agent to Mr. Edward Engel, a diamond broker of seventeen years' experience. The gems were faultless, but the low price set on them awoke suspicion that they were either stolen or spurious. Several local dealers examined them, using a microscope for the purpose, and pronounced them fine old mine diamonds, and worth five or six times their price. Mr. Engel then took them to New York and exhibited them to Messrs. Hiller and Bardell, importers and dealers in precious stones, who were also deceived by the appearance of the gems, until the owner mentioned his suspicions. Mr. Heller, remembering to have heard of a new process of painting diamonds, took one of the studs, estimated to be worth from 1000 to 1,500 dollars, washed it in soapsuds, and found it to be a cheap African diamond, worth perhaps 140 dollars. The rest of the set proved to have been tampered with in a similar manner. On returning to New Haven, Mr. Engel sought redress through the courts, and probably will get it.

The explanation is as follows: The common African diamonds are naturally a honey-yellow. On dipping one of them for a few minutes in an aqueous solution of aniline violet, and then letting it dry, it will be found that, while the lustre remains unimpaired, the colour is changed from yellow to the fine steel-blue usually observable only in the best stones. The two colours, yellow and violet, it will be noticed, are complementaries, and on blending produce the brilliant result described. The aniline is easily removed by the application of soapsuds, the water being tinged, not violet, but green, while the diamond regains its original yellow hue.—*Scientific American*.

Trade Notes.

The following paragraph from the last number of an American contemporary, quite harmonises with the one we reproduced last month, and makes us feel that we are quite behind the times as regards vigour of composition. We are trying to catch up.

"A typographical error in the advertisement of Messrs. Smith and Knapp in *The Circular* of last month, made us state that they dealt in gold and plated pencils instead of gold and plated jewellery. The fiend of a compositor who transformed jewellery into pencils has expiated his offence, and the Coroner has pocketed the customary fee."

The Watch and Clock Makers' Pension Society has just received a welcome addition to its funds in the form of a bequest of £50, less £5 legacy duty, under the will of the late Joseph Shepherd, Esq., a former Treasurer; but in reality it is a free gift from the testator's daughter, as will be seen by the following extract from a letter written to the present treasurer by Messrs. Mackreth, Bramall, & White, Solicitors, 47, Lime Street, E.C.—"We may mention that the legacy failed almost entirely under the Mortmain Acts; but Mrs. Sugden, the testator's daughter and residuary legatee, wished them paid notwithstanding."

The Watch and Clock Makers' Asylum has been similarly favoured.

We learn from the *Revue Chronométrique* that the school of Horology in Paris has recently been honoured by an official visit from the Minister of Commerce, accompanied by the President of the Paris Chamber of Commerce, and the Deputy of the Seine. These distinguished visitors remained two hours and a-half, and minutely examined every part of the establishment. It is mentioned as a proof of the excellent discipline maintained, that none of the pupils quitted their work-benches during this long visit. The Minister of Commerce subsequently presented one hundred and twenty works on Horology and the kindred industries, for the use of the pupils, with whose management and progress he and his colleagues declared themselves to be completely satisfied. When may we hope to have the pleasure of recording that a similar visit, with similar results, will have been paid to the Horological Institute, by the President and Secretary of the Board of Trade, and one of the Members for Finsbury?

International and Industrial Exhibitions continue to be the order of the day, and appear to yield satisfactory results to those who support them. The success of the Naval and Submarine Engineering Exhibition at the Agricultural Hall last year, determined its enterprising promoter, Mr. Samson Barnett, Junr., to organise another, under the title of the Marine and Mechanical Engineering and Metal Trades Exhibition, which will be held in the same place, from July 5th to 21st. Chronometers are to be exhibited by Messrs. G. Oram and Son.

The old Polytechnic Institution, Regent Street, now the property of the Young Men's Christian Institute, presented its former lively aspect during the week ending May 26th, as an Industrial exhibition of work executed by the members, was open to the public. Our space does not permit us to notice anything which is not directly connected with the trades represented by this Journal, and the show of such work was rather meagre. Dudley Settle (22) an apprentice—or improver—was awarded a prize of 21/- for two Five-o'clock Silver Tea Sets and other articles. A. A. Williams exhibited a Wrought-Iron Ornamental Clock-case with brass ornaments. W. Stevens, a Clock-case carved in Alabaster. L. Bangerter received a prize of 21/- for exhibits, which are thus described in the catalogue:—English Full-plate Lever Compensated Silver Hunter; made and finished by exhibitor. Two Three-quarter Plate Lever Compensated Keyless Watches; made *throughout* by exhibitor. We italicise the word "throughout," because the keyless work appeared to be of Lancashire origin. The Secretary, Mr. Robert Mitchell, stated, however, that the Judges took this into consideration in fixing the amount of the prize.

The International Fisheries Exhibition has given several exhibitors the opportunity of directing the attention of the public to the products of the pearl fisheries, otherwise the connection between jewellery and fishes is not, perhaps, quite apparent at first sight.

The Manufacturing Goldsmiths' & Silversmiths' Company, of 112, Regent Street, have been allotted a space in the principal entrance hall, immediately adjoining the exhibits of H.R.H. the Princess of Wales. The handsome show-case is sumptuously fitted up with blue velvet and satin, and the *recherché* nature of the display fully sustains the deservedly earned reputation of the company. Among other objects of interest we noticed a graduated assortment of coloured Oriental pearls, priced at £5000; a pair of Oriental pearls, £1000; a pair of bronze pearls, £360; and ten fine Scotch pearls, £453. A celebrated Paris house makes an attractive show in close proximity, but we are patriotic enough to feel pleasure in seeing the company successfully competing with it.

It will probably be remembered by our readers that only three chronometers were purchased by the Admiralty, at the termination of the last annual trial at the Royal Observatory, much to the surprise of the trade, as the two standing 4th and 5th, by James Poole and Co. and P. Birchall respectively, were very fine instruments. We are, however, enabled to state that the 4th one has just been purchased by the Transit of Venus Committee.

A very beautiful badge has just been made for the Tallowchandlers' Company. It consists of the Company's arms, very skilfully formed, and enriched with a number of pure white brilliants. The motto is "*Ecce Agnus Dei, qui Tollit Peccata mundi.*" The badge is altogether a fine specimen of art goldsmiths' work, and has been made by Messrs. J. R. Williams and Son, 108, Hatton Garden, who have previously produced many beautiful civic decorations. It may be stated that the Tallowchandlers were incorporated 2nd Edward IV., 1463. The original arms and crest were granted September 24th, 1463; the supporters and the second crest were granted and the arms confirmed by William Camden, Clarencieux, January 29th, 1602; and again entered in the visitation of London, taken in 1634.

The Queen has ordered from Messrs. George Edward and Sons, of Glasgow and London, a massive silver cup for presentation to the Royal Yacht Club, to be competed for at the regatta, which takes place about the middle of July next.

Watch thieves are evidently no respectors of persons, as the following incident will demonstrate. A police constable was engaged in clearing the Spread Eagle Hotel, Epsom, at eleven o'clock on the Derby day night, when he was relieved of his watch by one of the customers. The loss is made still more serious by the fact of the watch having been presented to the officer for some highly creditable act some time ago. The policeman did not find out his loss till both the thief and the watch had got out of his reach.

At the Manchester Police Court John Warren and Joseph Toner, were charged with burglariously entering the shop of Mr. L. Beaver, Jeweller, Cross Street, Manchester. A postman who was passing the shop early on Sunday, the 13th ult. heard a noise inside, and called the attention of the police, who quickly surrounded the premises, and then proceeded to effect an entrance. The prisoners attempted to escape by the roof, but were captured, and then a search of the premises was made. The police found that the burglars had effected an entrance through a side door by breaking two heavy locks. They had taken off a cast-iron door, secured by six heavy bars; then they had worked through a 14-inch brick wall. They found that Beaver's shop is lined with iron by trying to effect an entrance through the wall; they therefore forced a door leading to a cellar underneath the shop of the next house, and so got into Beaver's shop by removing another door. In the front of the shop an aperture is left for the police to notice the interior, but this had been covered with a clock face. They had not been able to gain access to the safe, in which there was £16,000 worth of jewellery, before they were interrupted; but a most complete and powerful set of burglars' tools were found on the premises. Inquiries have been made in various parts of the country as to the prisoners' antecedents, and replies have been received. The prisoners were committed to the assizes.

Mr. L. Beaver will doubtless congratulate himself on the strength and efficiency of his safes; during the last twelvemonth, several cases of attempted burglaries have come under our own notice where the thieves had been similarly baffled. According to an experienced locksmith of our acquaintance, there is very little skeleton key work attempted just now; but they rely on the more summary effect of the crow-bar. In this particular instance, it would appear that the police were somewhat at fault for not observing that the aperture was covered up, and therefore useless.

A most interesting and exhaustive paper on Technical Instruction in Elementary and Intermediate Schools was read to the members of the Society of Arts on May 23rd, by Philip Magnus, B. Sc., B. A. The Hon. Edward Lyulph Stanley, M.P., occupied the chair, and a discussion followed, which was taken part in by Messrs. Moss, E. N. Dixon, E. C. Robins, D. Walker, the Rev. Mr. Pearson, and the Chairman. We regret that we are unable to notice it in detail.

Index to Antique Rings and Ornaments.

85—A fine specimen of a signet ring from the Londesborough collection. It bears "a merchant mark" upon its face, which, in the reign of Queen Elizabeth, was used in stamping bales of merchandise, and thus denoting persons who were authorised to bear arms.

86—From the Londesborough collection. It is decorated with floral ornaments, engraved and filled with green and red enamel colours, the effect on the gold being extremely pleasing.

87—This beautiful ring is also from the Londesborough collection. Inside it bears the motto "Mon Cor Plesor," "My Heart's Delight." The hoop is richly decorated with floriated ornament cut upon its surface and filled in with niello, then extensively used by Goldsmiths for enriching their works.

88—The ring bearing the initials M A represents the gold signet ring of Mary, now preserved in the British Museum. The ring having the inscription M H forms part of the Waterton collection. It is the ring of Henry Lord Darnley, husband to Mary Queen of Scots. Within the hoop is engraved Henri L. Darnley, and the year of the marriage, 1565. Below it is engraved a *fac simile* of the interior of the ring as a plane surface.

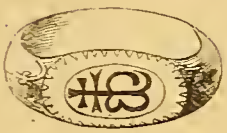
89—A ring very delicately engraved, bearing a representation of St. Christopher bearing the Saviour on his shoulder across an arm of the sea, in accordance with the old legendary history of this saint.

90—Forms also part of specimens in the Londesborough collection. The claws support the setting of a sharply pointed pyramidal diamond.

91—Supposed to be the seal ring of William Shakespeare; discovered near a churchyard in Stratford-on-Avon in the year 1810. It passed into the hands of R. B. Wheler, Esq., and after his death was transferred to the museum of Shakespearian relics, formed in the birth-place of the poet.

The Patent Laws.—A Scotch deputation, representing the Glasgow Philosophical Society and the Inventors' Institute of that city, recently waited on Mr. Chamberlain, at the Board of Trade, to urge on him certain amendments in the Patents for Inventions Bill—such as reduction of fees, adoption of a Government investigation to decide whether a proposed patent was novel, and an extension of the term of a patent from fourteen to seventeen years as minimum. On all these points, which the right hon. gentleman said were matters of principle, he said he could not assent to their wishes, but on some minor matters he agreed to give their representations every consideration.

ANTIQUE RINGS & ORNAMENTS.



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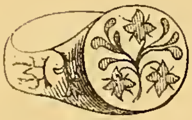

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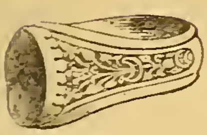

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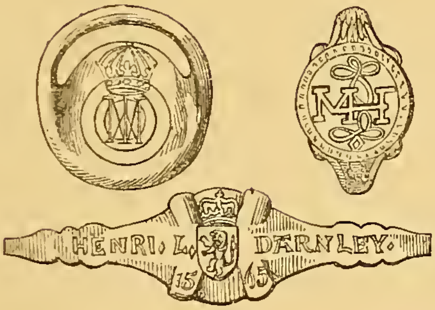
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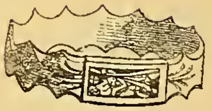

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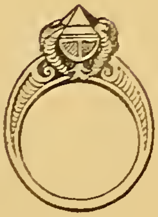

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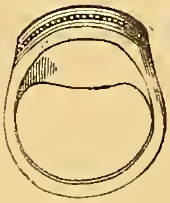

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For Description, see page 156.

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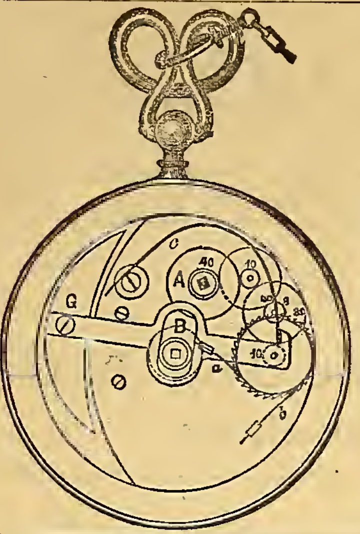

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